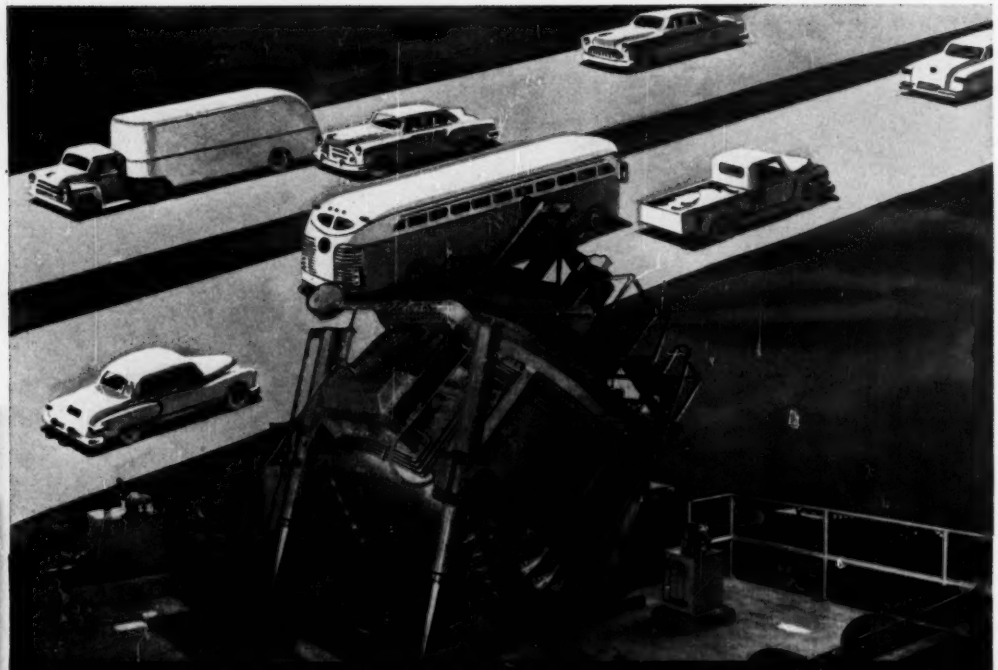
American

THE FOUNDRYMEN'S OWN MAGAZINE

Jan. 1951



WORLD-WIDE RECOGNITION

among the leading automotive manufacturers, too

Lectromelt Furnaces are now being built for the European automobile manufacturers, Fiat and Renault, and for a number of the industry's leaders in the United States—further evidence of the high esteem in which these furnaces are held by leading industrialists all over the world.

Parts Suppliers, too

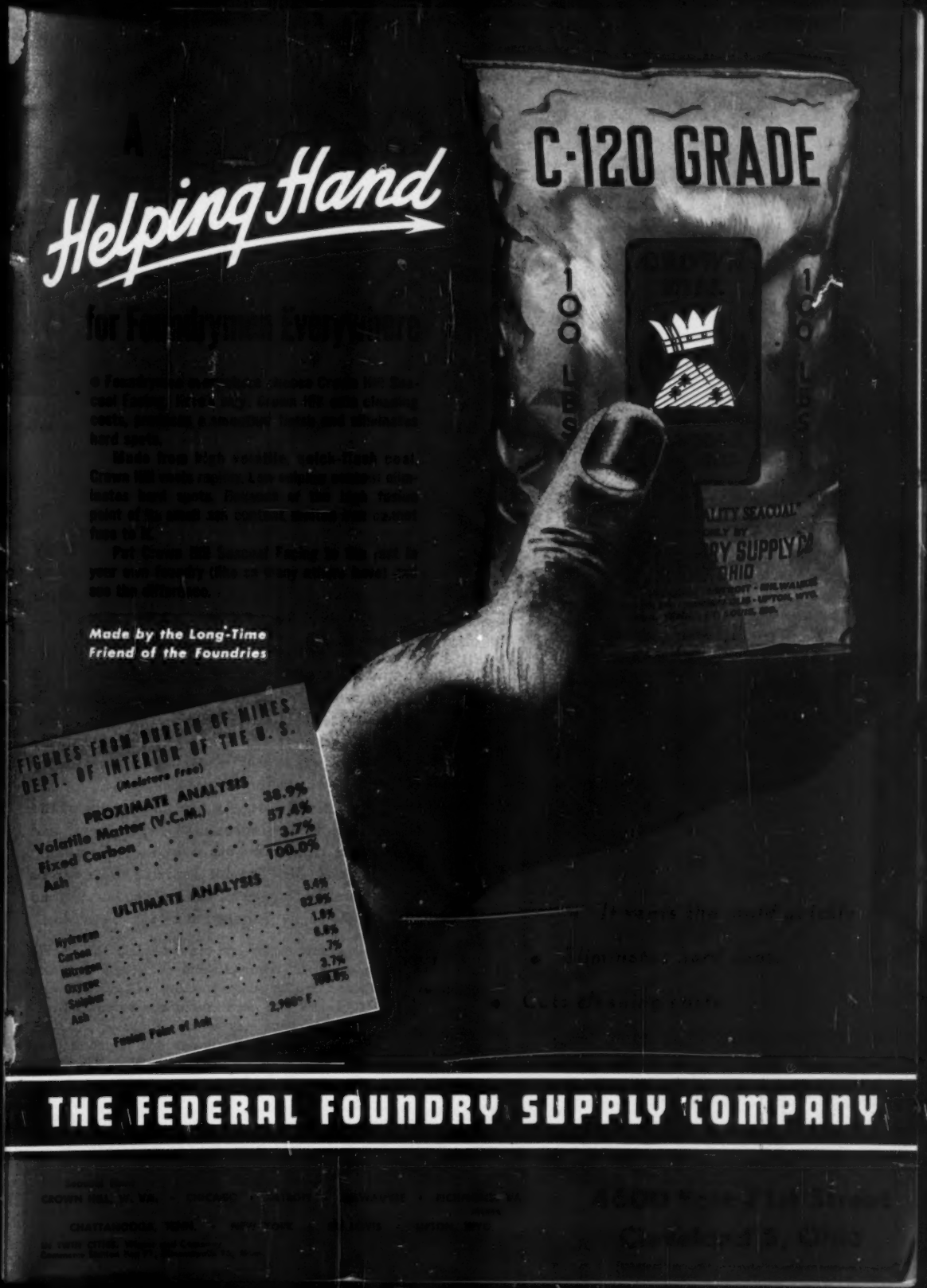
Lectromelt Furnaces have long been employed in making automotive parts: Piston rings since 1919, cylinder blocks since 1927, malleable products since 1925, as well as crankshafts and other products.

Lectromelt Furnaces offer you rapid top-charging, high-speed melting, accurate control of quality, low-cost operation. Lectromelt field engineers are available to help you keep abreast of the latest developments in the use of your furnace.

For Bulletin No. 7 giving you further data, write Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh 30, Pennsylvania.

Manufactured in... CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2... ENGLAND: Birlec, Ltd., Birmingham... SWEDEN: Birlec, Elektkougnar A/B, Stockholm... AUSTRALIA: Birlec, Ltd., Sydney... FRANCE: Stein et Roubaix, Paris... BELGIUM: S. A. Belge Stein et Roubaix, Brassouz-Liege... SPAIN: General Electrica Espanola, Bilbao... ITALY: Forni Stein, Genoa.

WHEN YOU MELT... MOORE RAPID *Lectromelt*


A
Helping Hand
C-120 GRADE
100 LBS.
100 LBS.
Made by the Long-Time
Friend of the Foundries
FIGURES FROM BUREAU OF MINES
DEPT. OF INTERIOR OF THE U. S.
(Moisture Free)
PROXIMATE ANALYSIS
Volatile Matter (V.C.M.) 38.9%
Fixed Carbon 57.4%
Ash 3.7%
100.0%
ULTIMATE ANALYSIS
Hydrogen 5.4%
Carbon 82.8%
Nitrogen 1.9%
Oxygen 6.8%
Sulphur .7%
Ash 3.7%
100.5%
Fusion Point of Ash 2,980° F.
THE FEDERAL FOUNDRY SUPPLY COMPANY

Mr. Wallace E. Thomas, President, Straight Line Foundry & Machine Corporation, Syracuse, reports hotter metal and lower melting costs.

ANOTHER FOUNDRY PRESIDENT
Reports on MODERNIZATION...

"charging our cupola by hand formerly required from seven to ten, full-time employees. With our MODERN charger we now use only three men — — a craneman . . . charger operator and a laborer."

President Thomas, at Straight Line Foundry & Machine Corporation, Syracuse also reports HOTTER METAL and LOWER MELTING COST! And hotter metal is sending more castings across the pay-scales. Largely responsible for both hotter metal and these timely savings in man-power is the MODERN, SMALL-CONE, SIDE-DISCHARGE bucket. As the four doors of the SMALL-CONE bucket swing open the coke, scrap and other components diffuse evenly over the full melting area of the cupola. Mr. Thomas explains the bucket's action in these words: **"a definite, uniform distribution along the periphery of the cupola permits our using a softer blast."**

The Straight Line installation and the SMALL-CONE bucket are good examples of the accomplishments brought about by MODERN engineers through their working TOGETHER with practical FOUNDRYMEN. For more information on this SMALL-CONE, wide diffusing action ask for new bulletin #147-AS: It's free to foundrymen who make request on their company stationery and write to Dept. AF-1, MODERN EQUIPMENT COMPANY, PORT WASHINGTON, WISCONSIN.

MODERN EQUIPMENT CO.
PORT WASHINGTON, WISCONSIN

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Ladles, Straight & Tapered	#149
Pouring Devices	#147

A. F. S.

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ABC

JANUARY, 1951

VOLUME XIX, NUMBER 1

American Foundryman

January, 1951

Official publication of American Foundrymen's Society

Editorial: Replacing Yesterday's Craftsmen: T. F. Hammer
Announce Tentative 1951 A.F.S. Convention Program
Member Support Puts A.F.S. Building Fund Over $60,000
Mold Materials are Factors in Gray Iron Shrinkage: W. F. Bohm
Coming A.F.S. Regional Foundry Conferences
Nominate 1951-52 A.F.S. Officers and Directors
Ferrous Casting in Australia
Modern Foundry Methods—Plaster Molding for Precision Casting Put on Production Basis: J. J. McClain
Statistical Quality Control Manages Foundry Operations: Robert J. Feltrin
Nodular Iron—A Bibliography: F. R. Morral
Foundry Sand—Getting Down to Fundamentals: C. E. Wenninger
Basic Lined Cupola Permits Use of Lower Grade Scrap and Coke: Sam F. Carter
Make Repair Welds on Large Gray Iron Castings: John H. Walsh
Foundry Education—Past, Present and Future: George K. Dreher
Who's Who
New A.F.S. Members
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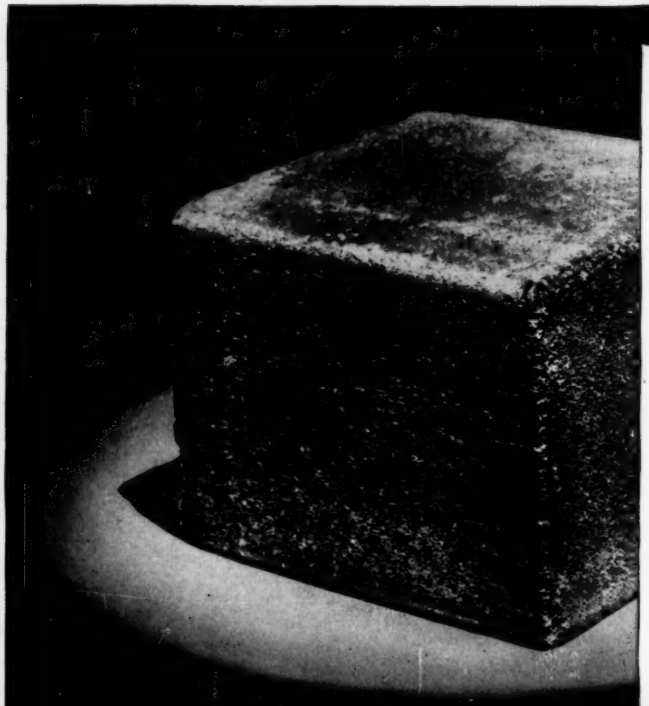
Mechanized cleaning and finishing of castings assumes increased importance with the rapid rise in production as foundrymen recall that cleaning rooms were often bottlenecks during the heavy castings demands of World War II. This rotating blasting barrel with mechanical loading and unloading at Yates-American Machine Co., Beloit, Wis., cleans in less than 30 minutes the pieces and parts which previously required 2½ to 3 hours.

Published monthly by the American Foundrymen's Society, Inc., 616 S. Michigan Ave., Chicago 5. Subscription price in the U. S., Canada and Mexico, $5.00 per year; elsewhere, $6.00. Single copies, 50c. Entered as second class matter July 22, 1938, under Act of March 3, 1879, at the Post Office, Chicago, Illinois. EASTERN REPRESENTATIVE—C. A. Larson & Associates, 254 West 31st St., New York 1, N. Y. CENTRAL REPRESENTATIVE—Enright & Cleary, 1836 Euclid Ave., Cleveland. MIDWESTERN REPRESENTATIVE—H. Thorpe Covington Co., 677 N. Michigan Ave., Chicago.

Providing Effective Deoxidation IN THE CUPOLA



FERROCARBO Briquettes are made from silicon carbide specially processed for metallurgical use and developed by The Carborundum Company as a cupola addition. Readily soluble in molten iron, a most effective deoxidizing action results.

Super-heated iron of greater fluidity is produced. Cleaner, sharper castings are poured. Foundry variables are lessened.

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FERROCARBO Briquettes

BY **CARBORUNDUM**
TRADE MARK

● **FERROCARBO Briquettes** are manufactured under U.S. Patents 2,119,521 and 2,497,745. The process of making cast iron through utilization of silicon carbide is registered under U.S. Patent 2,020,171.

Distributed in Canada by WILLIAMS AND WILSON, TORONTO, Montreal and Windsor.

"Carborundum" and "Ferrocarbo" are registered trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, N.Y.

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NEW DEVELOPMENTS IN ELECTRONIC HEATING!

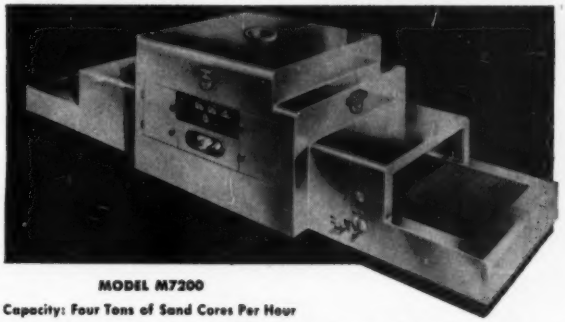
THER-MONIC
INDUCTION HEATING CORP. N.Y.C. U.S.A.

ENTIRE ONE-MAN CORE ROOM OPERATION NOW POSSIBLE WITH NEW CORE BAKING TURNTABLE!

Ther-monic Model 300-T bakes 350 to 500 lbs. of sand cores per hour . . . depending on their moisture content. Core blowers, rollover machines and benches can be placed adjacent to the turntable. One man can load and unload the cores from the turntable, remove the baked cores from the driers or core plates and immediately re-use them. Baked cores require no cooling-off period. Space-consuming cooling and storage racks are eliminated.

NEW THER-MONIC CORE BAKING TUNNEL BAKES 133 LBS. OF SAND CORES PER MINUTE, FROM START TO FINISH!

The Ther-monic core baking process makes it possible to reduce handling and breakage. Cores up to 20" x 60" in any length are baked evenly throughout, with no green centers. The Ther-monic process achieves a finer core finish, eliminates over-baked and burned surfaces. No cooling period is required . . cores, after leaving tunnel, are immediately ready for inspection and use. Ther-monic baked cores are highly resistant to cracking during the pouring operation—reduce finning to a negligible factor. Write for complete details!



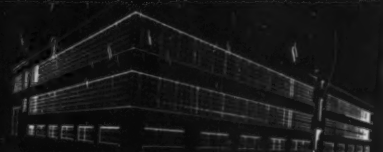
MODEL M7200

Capacity: Four Tons of Sand Cores Per Hour

Overall dimensions of Conveyor and Electrode Housing: 8' x 8' x 32'

INDUCTION HEATING CORPORATION

181 WYTHE AVE., BROOKLYN 11, N.Y.



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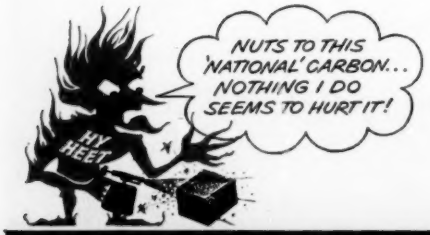
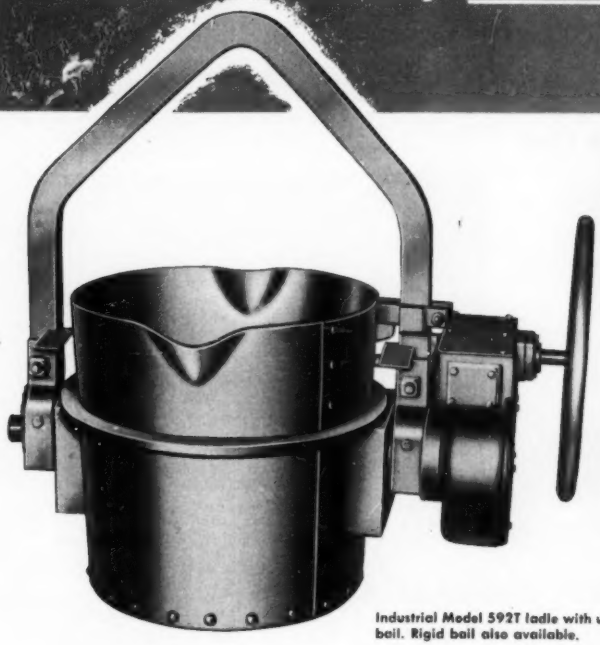
15 blast furnaces in the U.S. have each produced over 1,000,000 tons of iron on a single "National" carbon lining . . . and are still going strong!

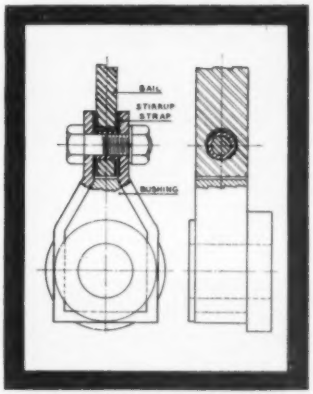


BLAST FURNACE LININGS • BRICK • CINDER NOTCH LINERS • CINDER NOTCH PLUGS • SKIMMER BLOCKS • SPLASH PLATES • RUNOUT TROUGH LINERS • MOLD PLUGS • TANK HEATERS

AT LAST... Binding due to heat distortion COMPLETELY ELIMINATED in this revolutionary Universal Bail Design



Industrial Model 592T ladle with universal bail. Rigid bail also available.



More flexibility than a universal joint. Ample vertical and horizontal adjustments. Misalignment taken care of by rotating swivel action.

Here is one of the really fundamental advances in geared ladle design. Binding problems caused by the steady rise in pouring temperatures have been solved . . . with no sacrifice in strength, safety, or simplicity.

You get four distinct advantages with this new universal bail by Industrial Equipment:

1. Binding due to heat distortion is eliminated.
2. Binding due to misalignment is eliminated.
3. Gear wear due to binding is eliminated.
4. No lubrication or adjustment is ever needed.

This new bail is the result of a project on which Industrial Equipment has been working for over four years. Many novel and ingenious designs were proposed and discarded before the final design was accepted. Like all good things it is simple. Yet notice that in addition to simplicity it is rugged, safe, and dependable.

You should also know that this new bail has been thoroughly foundry tested. We emphasize this because the more severe the conditions, the more evident was its design superiority. Operators, for example, say they have never operated a ladle that was easier to handle *regardless of conditions.*

Look to Industrial Equipment for the really basic improvements in foundry pouring and handling equipment. *Write, wire, or telephone today for full details.*

Do you have our revised catalog No. 35?

Industrial EQUIPMENT CO.

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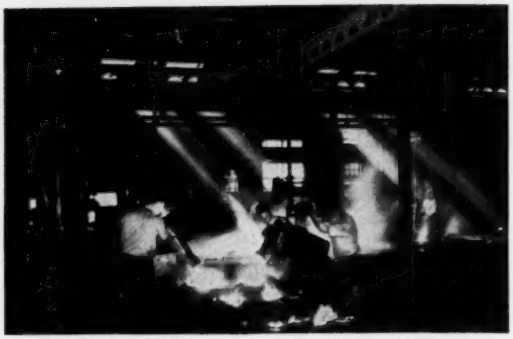
LADLES • BOWLS • SHANKS • BAILS • TONGS • SPECIAL EQUIPMENT

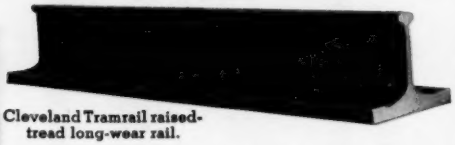
MATERIALS HANDLING IN THE FOUNDRY INDUSTRY

Many hundreds of foundries—grey iron—steel — malleable — brass — bronze — aluminum — magnesium — are enjoying numerous advantages possible with Cleveland Tramrail. They are speeding production and lowering costs by eliminating rehandling and providing straight-line production efficiency. They are reducing floor congestion, removing hindrances and confusion and promoting safety. In many instances, they are eliminating need of plant expansion by installing Cleveland Tramrail.



Pouring two 1000-lb. ladles simultaneously in the production of 200-lb. malleable castings. Each ladle is handled on an individual Cleveland Tramrail transfer bridge.

STANDARD ITEMS EASILY COMBINED TO HANDLE MATERIALS OF ANY KIND



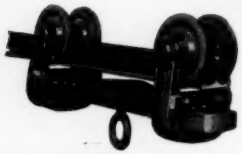
Cleveland Tramrail raised-tread long-wear rail.

Cleveland Tramrail consists of standard items such as rail, switches, carriers, cranes, hoists, grabs, etc., which can be combined in a thousand-fold ways to serve nearly every materials handling requirement.

Cleveland Tramrail Archbeam in seven sizes for various loads and conditions.

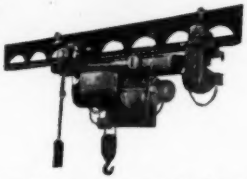
Nine 60-ton gondola cars of sand are unloaded, on an average, every 24-hour working day in a steel foundry, with two Cleveland Tramrail cranes and ½ yard grab buckets.

30,000 INSTALLATIONS



Hand propelled carrier built for long life and easy operation. Wheels have hardened tread and flange; bearings are double race type.

Backed by experience with 30,000 installations in industries of all types, Cleveland Tramrail representatives are in exceptionally good position to serve you. They will gladly advise, survey your plant, make layout or prepare quotation without obligation.



Motor-driven carrier with electric hoist. One of many types built by Cleveland Tramrail.

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Sand

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Hoists
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Fluxes
Ladles
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Sand Slingers
Stationary Melting Furnaces
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Parting Compounds

Hoists
Tumbling Mills
Core Ovens
Core Washes
Shovels
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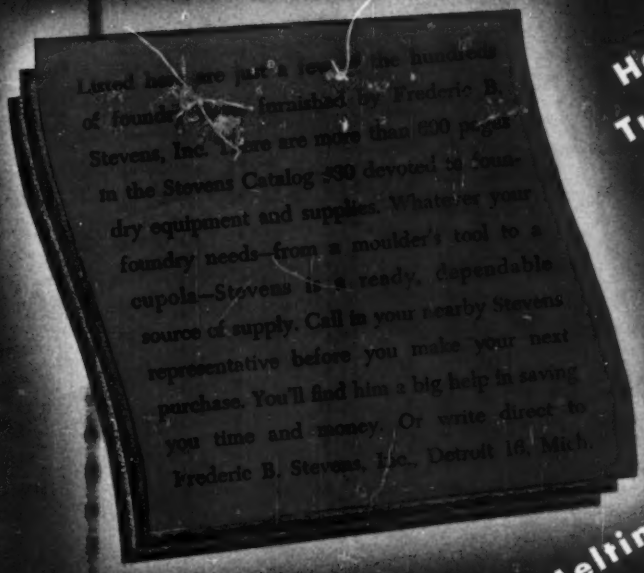
Mullors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Foundry CORE Practice

A Revision of "MODERN CORE PRACTICE AND THEORIES"

. . . dealing exclusively with the production and use of cores in the modern foundry

Fig. 117—Bench-type Core Blowing Machine

Fig. 190—High-frequency Dielectric Core Baking Oven

Written in practical, understandable language for operating men and metallurgists, FOUNDRY CORE PRACTICE covers the entire cycle of core-making operations . . . from materials and mixing methods to final setting of cores and molds.

A complete 500-page handbook, containing 316 photographs, graphs, and sketches, 81 tables and an extensive bibliography, the text covers:

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CORE BINDING MATERIALS
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FACTORS AFFECTING CORE STRENGTH
CORE VENTS AND THEIR CONTROL
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CORE COATINGS
CORE HANDLING
PROCEDURES FOR DETERMINING THE PROPERTIES OF CORES AND CORE MIXTURES
CONTROLLING CORE PROPERTIES
CORE SETTING
CORE KNOCK-OUT
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CASTING SURFACES AS AFFECTED BY CORE-SAND MIXTURES
ECONOMICS OF CORE PRODUCTION
DEFECTS CAUSED BY FAULTY CORES

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THE "Wrong Diet" KILLS MANY CASTINGS

TO MINIMIZE CASTING REJECTS AND SAVE TIME AND LABOR, MOLDS MUST BE "FED" CLEAN, MORE FLUID IRON.

Impurities in molten iron, and sluggish iron, are the wrong diet for castings. They must go before rejects can be minimized.

Famous CORNELL CUPOLA FLUX

CLEANSES MOLTEN IRON AND INCREASES ITS FLUIDITY.

Famous Cornell Cupola Flux causes a big reduction in sulphur and keeps the slag fluid.

Castings show a big reduction in chilled sides, hollow centers, hard spots, etc. and they are more easily machined.

Cupola operation is more efficient. Drops are cleaner, there is less erosion of brick or stone lining, and amazing reduction in maintenance time and labor.

Write for Bulletin No. 46-B

SCORED BRICK FORM

makes it the easiest and cheapest flux to use. All you do is lift Famous Cornell Cupola Flux from container and toss it into cupola with each ton charge of iron, or break off one to three briquettes (quarter sections) for smaller charges, as per instructions.

Famous CORNELL ALUMINUM FLUX

CLEANSES MOLTEN ALUMINUM so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive Formula greatly reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

The CLEVELAND FLUX Co.

1026-1040 MAIN AVENUE, N. W.
CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum Flux Since 1918

FAMOUS FLUXES
Trade Mark Registered

Famous CORNELL BRASS FLUX

CLEANSES MOLTEN BRASS even when dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves you considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

Cut CLEANING ROOM COSTS WITH FINER FINISH CASTINGS

DELTA S-5 BLACKOAT CORE AND MOLD WASH

Delta Blackoat S-5 Core and Mold Wash, for grey iron castings, is a product of scientific research, conducted by Delta Foundry Research Laboratory in cooperation with one of the leading grey iron foundries in the mid-west. It's development solves critical difficulties, inherent in grey iron casting, which have persistently plagued foundrymen and foundry technicians.

Delta Blackoat S-5 is a distinctly new and different wash. It provides all of the well-known advantages of other Delta Core and Mold Washes plus the added advantages listed below.

Write for complete information. If you wish it we will send a liberal working sample to you for test purposes in your foundry.

5 IMPORTANT FACTS TO CONSIDER . . .

1. It's new and different. It has qualities and characteristics contained in no other wash. It substantially reduces cleaning room costs and greatly improves casting finish.
2. It produces results, on grey iron castings, unequalled by any other wash. It will not deform cores. Edges and corners remain clean and sharp.
3. It costs less to buy and is considerably more economical because you use it at a lower Baume.
4. It can't flake or peel because it anchors itself by penetrating onto the sub-surface sand grains of cores and molds. It greatly increases the surface hot strength of the sand which prevents veining and metal penetration.
5. It is easily applied and adheres to any sand surface . . . green or dry . . . and produces a smooth, highly refractory, waterproof surface over which molten metal flows faster and without interruption.

DELTA OIL PRODUCTS CO.

MILWAUKEE 9, WISCONSIN

Counsel Offered

ON METAL PROBLEMS

Because of unusually heavy industrial and defense demand, rationing of nickel has been in force since July 1st. However, we believe that dissemination of technical data and service experience can help to promote the intelligent utilization of critical materials, so essential in these times. We shall, therefore, continue to issue information on new developments and user experience with nickel-containing materials.

"INCO" TECHNICAL SECTIONS

Consultation on technical problems relating to alloys containing nickel is invited. Consult the nearest Technical Field Section of INCO Development and Research Division listed below:

CANADIAN SECTION
25 King Street, West,
Toronto 1, Ont.
Tel. Elgin 7471

CENTRAL ATLANTIC COAST SECTION
67 Wall Street,
New York 5, N. Y.
Tel. Whitehall 4-1000

CHICAGO SECTION
333 N. Michigan Avenue,
Chicago 1, Ill.
Tel. Franklin 2-4020

CINCINNATI SECTION
Carew Tower,
Cincinnati 2, Ohio
Tel. Parkway 1631

DETROIT SECTION
General Motors Building
Detroit 2, Mich.
Tel. Trinity 5-3436

EMPIRE STATE SECTION
Genesee Valley Trust Bldg.,
Rochester 14, N. Y.
Tel. Locust 5884

NEW ENGLAND SECTION
75 Pearl Street
Hartford 3, Conn.
Tel. Hartford 7-0383

PITTSBURGH SECTION
Grant Building
Pittsburgh 19, Pa.
Tel. Atlantic 1-0646

ST. LOUIS SECTION
Ambassador Bldg.,
St. Louis 1, Mo.
Tel. Garfield 4197

TEXAS SECTION
Comperce Bldg.,
Houston 2, Texas
Tel. Charter 4234

TWIN CITIES SECTION
Northwestern Bank Bldg.,
Minneapolis 2, Minn.
Tel. Geneva 0631

WEST COAST SECTION
Petroleum Bldg.,
Los Angeles 15, Calif.
Tel. Prospect 2496

STOCK AND SERVICE CENTERS FOR "INCO" PRODUCTS

The following are sources of supply for primary nickel for alloying purposes. Through casting specialists, they are prepared to offer technical service on the production of ferrous and non-ferrous castings containing nickel.

ATLANTA 3
J. M. Tull Metal & Supply Co.
285 Marietta Street
Tel. Walnut 3525

BALTIMORE 17
Whitehead Metal Products Company, Inc.
413 West North Avenue
Tel. Lafayette 2300

BUFFALO 2
Whitehead Metal Products Company, Inc.
254 Court Street
Tel. Cleveland 1475

CAMBRIDGE 39, MASS.
Whitehead Metal Products Company, Inc.
281 Albany Street
Tel. Trowbridge 6-4680

CHICAGO 23
Steel Sales Corporation
3348 South Pulaski Road
Tel. Bishop 7-7700

CINCINNATI 29
Williams and Company, Inc.
3231 Fredonia Avenue
Tel. Capitol 3000

CLEVELAND 14
Williams and Company, Inc.
3700 Perkins Avenue
Tel. Utah 1-5000

COLUMBUS 8, OHIO
Williams and Company, Inc.
851 Williams Avenue
Tel. Klondike 1623

DALLAS 9
Metal Goods Corporation
6211 Cedar Springs Road
Tel. Elmhurst 3271

DENVER 5
Metal Goods Corporation
Municipal Service Center
37th at York
Tel. Acoma 5891

DETROIT 10
Steel Sales Corporation
5151 Wesson Avenue
Tel. Tyler 6-3000

EDMONTON, ALBERTA
Wilkinson Company, Ltd.
8411 103rd Street
Tel. 35834

HARRISON, N. J.
Whitehead Metal Products Company, Inc.
1000 South 4th Street
Tel. Humboldt 5-5900

HOUSTON 3
Metal Goods Corporation
711 Milby Street
Tel. Central 6881

INDIANAPOLIS 2
Steel Sales Corporation
1916 North Meridian Street
Tel. Talbot 1506

KANSAS CITY 8, MO.
Steel Sales Corporation
2201 Grand Avenue
Tel. Victor 7270

LOS ANGELES 21
Pacific Metals Company, Ltd.
1400 South Alameda Street
Tel. Prospect 0171

MILWAUKEE 4
Steel Sales Corporation
647 West Virginia Street
Tel. Daly 8-6840

MINNEAPOLIS 15
Steel Sales Corporation
529 South 7th Street
Tel. Nestor 6614

MONTREAL 1
Robert W. Bartram, Limited
455 Craig Street West
Tel. University 3711

NEW HAVEN 13
Whitehead Metal Products Company, Inc.
265 Church Street
Tel. New Haven 8-0275

NEW ORLEANS 12
Metal Goods Corporation
432 Julia Street
Tel. Canal 7373

NEW YORK 14
Whitehead Metal Products Company, Inc.
303 West 10th Street
Tel. Watkins 4-1500

PHILADELPHIA 40
Whitehead Metal Products Company, Inc.
1955 Hunting Park Avenue
Tel. Baldwin 9-2323

PITTSBURGH 33
Williams and Company, Inc.
901 Pennsylvania Avenue
Tel. Cedar 1-8600

PORTLAND 12, ORE.
Eagle Metals Company
2336 North Randolph Avenue
Tel. Tuxedo 8201

ST. LOUIS 10
Steel Sales Corporation
4565 McRee Avenue
Tel. Grand 5255

SALT LAKE CITY 4
Pacific Metals Company, Ltd.
1186 South Main Street
Tel. Salt Lake City 8-3421

SAN DIEGO 1
Pacific Metals Company, Ltd.
1533 India Street
Tel. Franklin 9-5826

SAN FRANCISCO 10
Pacific Metals Company, Ltd.
3100 Nineteenth Street
Tel. Mission 7-1104

SEATTLE 4
Eagle Metals Company
3628 East Marginal Way
Tel. Eliot 4764

SPOKANE 8
Eagle Metals Company
East 320 Trent Avenue
Tel. Madison 2419

SYRACUSE 4
Whitehead Metal Products Company, Inc.
207 W. Taylor Street
Tel. Syracuse 3-0158

TOLEDO 2
Williams and Company, Inc.
630 East Woodruff Avenue
Tel. Adams 8101

TORONTO 5
Alloy Metal Sales Limited
881 Bay Street
Tel. Princess 2831

TULSA 3
Metal Goods Corporation
201 North Boston Street
Tel. Tulsa 4-1175

VANCOUVER, B. C.
Wilkinson Company, Ltd.
Tel. Fairmount 6101
186 West Second Avenue

EMBLEM OF INCO SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC.

67 WALL STREET
NEW YORK 5, N.Y.

High Quality CLAYTON SILICA SAND

Meets Your Most Exacting Specifications

The Uniformity YOU Want . . .
. . . Is the Uniformity WE Deliver

Our special processing, large production capacity and unlimited supply of raw material enable us to give you prompt, year 'round shipment of uniform foundry sand.

CLAYTON SILICA is high quality Silica Sand from the St. Peter sandstone family. Clayton Silica is carefully graded, screened and dried, and will meet your exact foundry needs. AFS fineness from 55 to 85.

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of Integrity

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In a magazine, the value of "the neighborhood" stems from the character of the editorial content, so that the character of the publication projects itself into reader acceptance.

This appreciation of a desirable background is one reason why AMERICAN FOUNDRYMAN enjoys a record of 92% renewals on all contracts since advertising became a regular feature in "The Foundrymen's Own Magazine."

Editorially, AMERICAN FOUNDRYMAN enjoys a reputation for **integrity** that meets the most exacting demands for presentation of the latest, most reliable information pertaining to cast metals. AMERICAN FOUNDRYMAN, therefore, offers advertisers more than different units of white space for their advertising messages . . . it provides the correct **background** to insure the reader acceptance that results in industry recognition and sales.

AMERICAN FOUNDRYMAN

ABC

The Foundrymen's Own Magazine 616 S. MICHIGAN AVE. CHICAGO 5, ILLINOIS

Advertisement

ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Division, Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

MANGANESE . . .
Deoxidizer and Toughener for Steel

Manganese is one of the most important alloys used in making steel. It is practically indispensable as a deoxidizer and cleanser for improving the hot-working properties of steels. When used as an alloying element, it makes steel stronger and tougher and it is therefore an important constituent of many structural and engineering steels.

Deoxidizes and Cleans Steel

The effectiveness of manganese in deoxidizing steel was first recognized in 1856, when it was used in the Bessemer process of steelmaking to counteract the bad effects of sulphur; in fact, manganese made this process a commercial success. Today, manganese is used as a deoxidizer and cleanser in the production of nearly all grades of open-hearth and electric-furnace steel, as well as high-grade cast iron.

Research work carrried out recently in ELECTROMET'S laboratories at Niagara Falls, New York, has provided new and important information on the value of manganese as a deoxidizer. This work shows that manganese is a more effective deoxidizer than has been previously realized; and that a combination alloy of silicon and manganese is a much stronger deoxidizer than either silicon or manganese by itself. Complete information is given in a report entitled "Solubility of Oxygen in Liquid Iron Containing Silicon and Manganese." If you would like a copy of this report, free of charge, write to the address above.

Improves Hot-Working Properties

By combining readily with sulphur, manganese performs another valuable job, it removes the principal cause of hot-shortness or brittleness—thereby giving steel better rolling and forging properties. In this reaction, the manganese combines with the sulphur to form manganese sulphide, as follows:

$$Mn + FeS = MnS + Fe$$

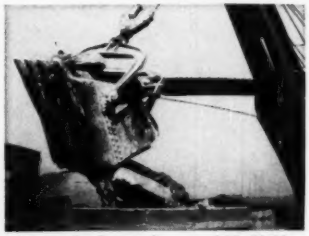
The manganese sulphide remaining in the steel is a less harmful type of inclusion than the iron sulphide would be, the hot-working properties of the steel are improved.

The weakening and embrittling tendencies of sulphur in cast iron can also be counteracted by the addition of manganese to the cupola charge.

Increases Strength, Toughness, and Wear-Resistance

When used as an alloying element in steel, manganese produces a steel with greater strength and toughness, and there is no serious loss of ductility. Additions of about 13 per cent manganese produce the well-known Hadfield manganese steel. High-manganese steels have exceptional resistance to wear; and consequently they have many applications in engineering jobs. Instead of wearing away quickly under conditions combining severe pressure, shock, and abrasion, these steels actually become harder through use. Thus, they last longer.

Because of the tendency of high-manganese steels to work-harden, they serve industry in important and varied applications. Manganese steel castings, for example, are used for railroad frogs and crossings, rock-crusher parts, steam-shovel dipper teeth, and dredge-bucket lips. The chief applications of manganese steel are in rails used for special service, and light forgings subjected to heavy wear.



Dipper bucket teeth, cast of Hadfield manganese steel, actually increase in hardness under abrasive wear from gravel and rock in construction work — thus last many times longer than those of ordinary steel.

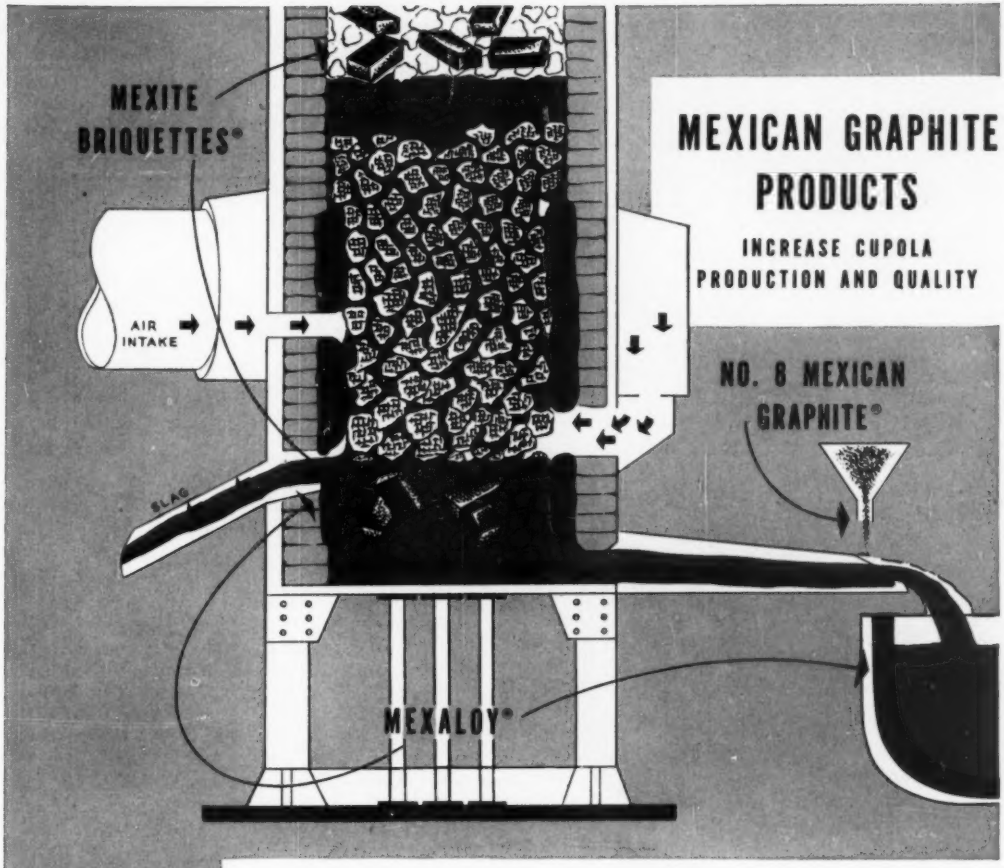
Available Alloys

Manganese is produced by ELECTROMET in forms suitable for every use of the iron, steel, and non-ferrous metal industry. The products listed below are available from ELECTROMET plants or warehouses. For a complete description of these alloys, write for a copy of the 100-page booklet, "ELECTROMET Ferro-Alloys and Metals."

The terms "EM" and "Electromet" are registered trade-marks of Union Carbide and Carbon Corporation.

Alloys of Manganese and Their Uses

Standard Ferromanganese	The product most commonly used for adding manganese to steel for the purpose of alloying or deoxidizing and cleansing.
Low-Carbon Ferromanganese	For adding manganese to steels having a low carbon content, such as stainless steels of the 18 per cent chromium, 8 per cent nickel type.
Medium-Carbon Ferromanganese	Commonly used for making manganese steel containing 1.50 to 2.00 per cent manganese, and in the production of Hadfield manganese steel.
Low-Iron Ferromanganese	For applications in the nickel, aluminum, and copper industries where a low-iron alloy is required.
Silicomanganese	Used by the steel industry as a furnace block; as a deoxidizer; and also for manganese additions, particularly in the production of engineering steels containing 0.10 to 0.50 per cent carbon.
Ferromanganese-Silicon Mix	Used as a ladle inoculant for cast iron.
Manganese Metal	Used as a deoxidizing agent and alloying element in the production of non-ferrous alloys.
"EM" Silicomanganese Briquets	For adding manganese (with silicon) to cast iron ... the cupola.
"EM" Ferromanganese Briquets	For adding manganese (without silicon) to cast iron in the cupola.



MEXICAN GRAPHITE PRODUCTS

INCREASE CUPOLA PRODUCTION AND QUALITY

MEXITE BRIQUETTES. One 4-lb. Mexite Briquette provides the same carbon content as 50 lbs. of pig iron when introduced into the cupola charge. Not only do Mexite briquettes sharply reduce melting costs per ton; they also *reduce the range of carbon content fluctuation* and give a steadier carbon analysis, a particularly vital factor when high percentages of steel are charged.

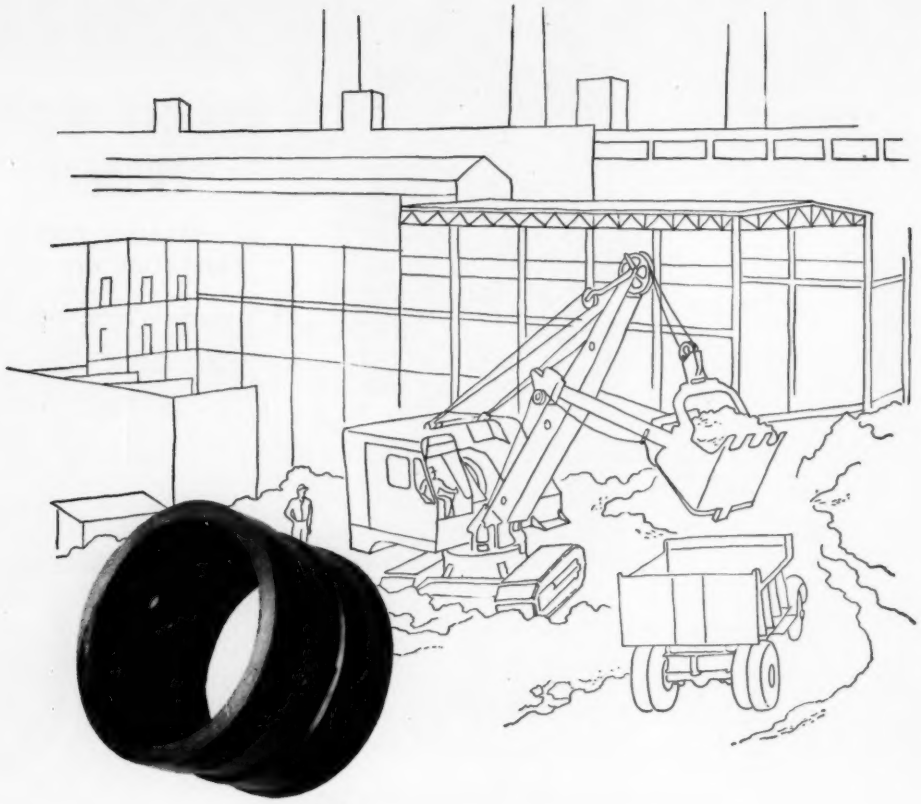
MEXALOY, applied to cupola linings, ladles, and spouts, resists molten metal and slag and keeps metal free from refractory inclusions. Its natural lubricating action provides low friction surfaces which part easily from metal and slag. A Mexaloy mixture is *easily applied to any clean surface.* Because it will not melt or change character under intense heat, Mexaloy gives longer refractory life with lower maintenance cost.

No. 8 MEXICAN GRAPHITE is used for ladle additions to treat grey cast iron. Trickled into the cupola spout as metal falls into the ladle or with a direct ladle addition, it greatly reduces chill and hardness, *producing castings of increased machineability.* Normally only 2 lbs. of No. 8 need be added per ton of molten metal — a cost of only ten cents per ton — to assure castings which require no annealing. Write today for complete information on how Mexite Briquettes, Mexaloy, and No. 8 Mexican Graphite will give you better castings for less money.

149

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN



to be sure

The HARNISCHFEGER CORPORATION uses FEDERATED BRONZE INGOT

More materials-handling equipment is made by the Harnischfeger Corporation, Milwaukee, than by any other manufacturer in the world. In almost all of it, bronze bushings, bearings, gears and other important bronze parts are cast of Federated metal to assure long, hard, uninterrupted service.

One of the more important applications is the swing gear bushing shown above. The Harnischfeger foundry casts this power shovel bushing of Federated 80-10-10 because it casts easily and bears its extremely heavy load with consistent success.

Like Harnischfeger, you, too, can be *sure* when you buy from Federated's complete line of brass, bronze, aluminum and magnesium alloys.

To get information or to order, call or write any of Federated's 22 sales offices across the nation.

Federated Metals Division

Federated first in the non-ferrous field FMD

AMERICAN SMELTING AND REFINING COMPANY • 120 BROADWAY, NEW YORK 5, N. Y.

"We get 3 times the production with half the manpower"

A partial list of companies who have purchased THERMEX Electronic Core-Baking Equipment

- American Hardware Corp.
- Brugger Manufacturing Co.
- Crane Co.
- Grand Haven Brass Foundry
- Grinnell Company, Inc.
- Moline Malleable Iron Co.
- National Malleable & Steel Castings Co.
- Phoenix Brass Fittings Corp.
- F. Ronci Co.
- United Foundries, Inc.
- United States Pipe & Foundry Co.

THERMEX - T. M. Reg. U. S. Pat. Off.

BEFORE this progressive foundry* installed THERMEX Core-baking Equipment, oven baking of 240 typical cores took two hours. Now, with electronic baking, the same job can be done in 40 minutes! And one man operates the THERMEX Core-baking Equipment, where two men were required with an oven.

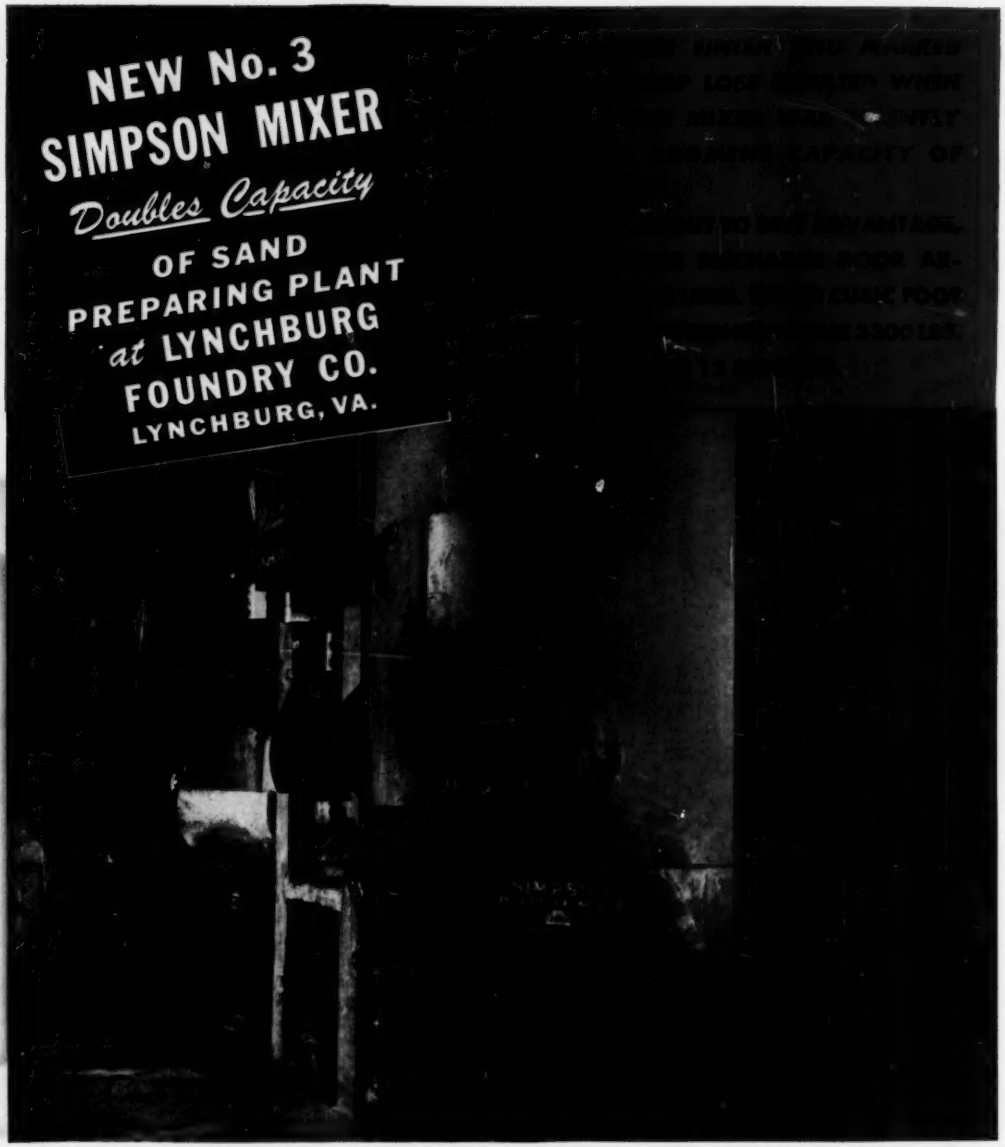
Here are other advantages realized...

- 99% of cores now pass inspection, where reject rate formerly was 10 to 40%.
- "Dri-box", a plastic drier developed by Girdler engineers has proved perfect for the purpose.
- Requirements for core plates have been reduced by 75%—since baking time has been cut.
- Energy used varies with the requirement of the load—eliminates waste energy—unused power.
- A few standard mixes now take care of all cores.
- Baking tunnel is ready at the flip of a switch—no time is lost firing the oven.

Girdler has manufactured high frequency di-electric heating equipment in capacities from ½ ton to 15 tons per hour. You'll want complete data on THERMEX Electronic Core-baking Equipment. Write The Girdler Corporation, Thermex Division, Louisville 1, Kentucky.

*Name on request.

GIRDLER CORPORATION
Thermex Division



SIMPSON Intensive MIXERS

SIMPSON MIXERS WILL HELP YOU TO IMPROVE YOUR PRODUCT AND REDUCE COSTS. YOUR NATIONAL ENGINEER WILL BE GLAD TO ASSIST IN PLANNING THE INSTALLATION.

NATIONAL *Engineering Company*

600 Machinery Hall Bldg. • Chicago 6, Illinois

Manufacturers and Selling Agents for Continental European Countries—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd., Sydney, Australia

REPLACING YESTERDAY'S CRAFTSMEN

WHILE American Industry is assuring a supply of college-trained men through scholarships, promoting new technological developments through research grants, and making gifts to universities and colleges, it is overlooking the importance of building up and maintaining the supply of highly skilled craftsmen. These skilled workers have been the backbone of American superiority in manufacturing and to them must be attributed our sense of "know how" and "Yankee ingenuity."

All of our skilled men have not been native Americans for in the past we have benefited in fair measure from craftsmanship taught in Europe. This source has largely disappeared due to war, immigration limitations, promotions, and death. Mechanization is not the answer to the growing scarcity of skilled workers—for more machinery calls for more mechanical skill.

Where should Industry turn in its search for craftsmen? To the high schools, surely, for it is at high school age that aptitudes begin to show in students. But the typical high school curriculum of today embraces little in the way of manual training, the emphasis centering instead on an academic course. This course must include students who are not well qualified and who have no aspirations for entering college, as well as those who are qualified and require a better preparation for college.

Industry's support in the way of gifts and services to high schools presupposes a radical change in the present concept of high school education. The present curriculum might well be separated into three groups of courses: Academic, Commercial, and Vocational. Students could be fairly well typed by aptitudes and interests in these three categories. The result would be a higher standard of education in all branches.

The introduction of a well-staffed well-equipped vocational department would, to a large degree, correct one of America's greatest educational shortcomings that is well demonstrated by the fact that over 50 per cent of our high school pupils—a million a year—drop out before graduation. Certainly if the subjects offered were more suited to the student's needs, more of them would pursue their learning to the end.

The advantages to Industry of such a plan would be manifold. High school graduates of vocational courses would be equipped with salable skills. In applying for a job, they would have a good working knowledge of its requirements. (Any employment office knows that 90 per cent of the younger applicants for a skilled job know nothing about the work except the rate of pay.) The three-fold curriculum proposed would make for better adaptation to a position in life.

What can Industry do to help build up its supply of skilled men until an educational plan such as that proposed can be put into effect? Industry can arrange plant tours for the benefit of local high school classes and their teachers. Annual prizes to students achieving high efficiency in industrial arts can be awarded. Industrial plants can give gifts of machinery and supplies for use in vocational classes. No opportunity to assist in vocational guidance work through talks before groups of students, or through participation in the vocational guidance "clinics" held in some cities, should be overlooked.

Another highly effective program is to impress on parents and educators the part local industry plays in supporting the town through wages, taxes, purchases, and providing opportunities for careers. This can be done by means of talks before civic and similar groups, and through dinners held in a plant or a local club.

These and other stop-gap measures which can be devised will go a long way toward bringing back the supply of skilled craftsmen so sorely needed by foundries and other branches of Industry.

T. F. HAMMER, *President*
Malleable Iron Fittings Co.
Branford, Conn.

T. F. Hammer, president, Malleable Iron Fittings Co., Branford, Conn., where his company is the largest industry, has an unusual opportunity for observing directly the effect of public high school education on the chosen careers of local students. He finds that many of these boys, sons and grandsons of the company's employees, inherit a latent native ability in skilled craftsmanship. With the idea of helping these students to recognize their aptitudes in such fields, the Malleable Iron Fittings Co. has done much towards encouraging vocational study in the local schools. Machinery has been donated, and annual prizes awarded in the various branches of industrial arts. And opportunities are arranged for students to inspect the plant in operation and to hear talks by company executives. The son and grandson of MIF Co. presidents, Mr. Hammer is a native of Branford, where he obtained his early schooling. He served in Naval Aviation in the First World War, and received a degree from Yale Sheffield Scientific School in 1918.

announce TENTATIVE PROGRAM for 55th A.F.S. CONVENTION

BUFFALO APRIL 23-26, 1951

FINALIZATION OF PLANS for the 1951 Convention of American Foundrymen's Society, to be held April 23 to 26 in Buffalo, is now in effect with publication of a tentative four-day technical program, formation of host chapter convention committees, mailing of convention housing applications, and completion of arrangements for the 28th A.F.S. Apprentice Contest.

Convention housing applications and a copy of the tentative technical program for the Convention (see opposite page) were mailed early this month to all members of the Society in order that they may determine sessions and Convention events of interest and request housing accommodations accordingly.

Tentative program of events for the 1951 Convention includes four days of technical sessions, plus such annual Convention highlights as the A.F.S. Annual Meeting, Charles Edgar Hoyt Annual Lecture, Annual Banquet, Aluminum & Magnesium Round Table Luncheon, Brass & Bronze Round Table Luncheon, Malleable Round Table Luncheon, Pattern Round Table Luncheon, Gray Iron Round Table Luncheon, Steel Round Table Luncheon, Educational Dinner, Canadian Dinner, A.F.S. Alumni Dinner (by invitation only), visitations to Buffalo area foundries and allied industrial plants, a concurrent program of Ladies' Entertainment, and the popular Gray Iron, Sand, and Brass & Bronze Sand Shop Courses, held evenings and open to all foundrymen of the Buffalo area free of charge.

Featured event of the 1951 Convention technical program this year will be a *Symposium on Gating and Risering*, to be held the morning and afternoon of Tuesday, April 24. Aluminum & Magnesium, Brass & Bronze, Gray Iron, Malleable, and Steel Divisions of the Society will jointly sponsor this outstanding discussion by the nation's experts on a timely subject.

Morning session will start at 9:00 and will deal with theoretical aspects of gating and risering. R. F. Thomson, General Motors Corp., Detroit, will preside, introduce authors of papers to be presented, and outline purposes of the Symposium. Following this, L. W. Eastwood, Battelle Memorial Institute, Columbus, Ohio, will report progress of A.F.S. gating and risering research at Battelle, and a representative of Naval Research Laboratory, Washington, D. C., will give a resume of fluid flow work done there. Next, Arthur K. Higgins, Allis-Chalmers Mfg. Co., Milwaukee, will discuss *"Considerations in the Feeding of Castings."* Concluding paper of the morning session of the Symposium will be presented by Howard F. Taylor of the Massachusetts Institute of Technology. Each morning session speaker will be limited to 25 minutes, with 10 minutes allowed for discussion of each paper presented.

Afternoon sessions will be in charge of Divisional chairmen and will consist of successive half hour discussions of gating and risering as applied to each Division—Aluminum & Magnesium, Gray Iron, Brass & Bronze, Malleable, and Steel.

Buffalo, Queen City of the Great Lakes and New York's second largest city, will be host to 55th Convention of the American Foundrymen's Society, April 23 through 26. Focal point for ships bringing Minnesota iron and railroads bringing Pennsylvania coal, Buffalo has been a center of the casting industry since its first foundry was established prior to 1840. Rich in industrial attractions, Buffalo also offers unrivalled scenic beauty at nearby Niagara Falls, Cave of the Winds, Buckhorn Island State Park, Tonawanda Indian Reservation and the International Peace Bridge between U. S. and Canada.

Top technical address this year, as in past years, will be the Charles Edgar Hoyt Annual Lecture, with James C. Zeder, director of engineering and research, Chrysler Corp., Detroit, as speaker. Another technical feature will be presentation of the Annual Exchange Paper of the Institute of British Foundrymen, to be given this year by E. £. Renshaw, head foundry metallurgist, Ford Motor Co., Limited, Dagenham, England.

Technical sessions of the 1951 A.F.S. Convention have been so arranged as to avoid conflict of interests wherever possible. Non-ferrous and malleable sessions will be held at the beginning of the Convention week, general interest sessions in the middle of the week and gray iron and steel sessions at week's end. Thus it will be possible for foundrymen with limited time to attend sessions of particular interest to them within a three-day period.

Aluminum & Magnesium Division will open its two-day technical program with a morning technical session, the Aluminum & Magnesium Round Table Luncheon, and a late afternoon technical session on Monday, April 23. The Division's program on Tuesday, April 24, will include participation in the *Symposium on Gating and Risering* in the morning and afternoon and a technical session that afternoon.

Brass & Bronze Division's technical program will open Monday morning, April 23 with a technical session, followed by the Brass & Bronze Round Table Luncheon and a late afternoon technical session. In the evening, the first of two Brass & Bronze Sand Courses will be held. On Tuesday, the Division will participate from 9:00 a.m. to 12:00 noon and from 2:00 p.m. to 4:00 p.m. in the *Symposium on Gating and Risering*. Concluding the Division's technical program will be the second and final Brass & Bronze Sand Course at 8:00 p.m.

Malleable Division will open its two-day technical

Tentative Schedule of Sessions

1951 A.F.S. Convention
Buffalo—April 23-26

Monday, April 23

8:30 a.m.	Registration Begins
10:00 a.m.	Technical Sessions
	Aluminum & Magnesium
	Brass & Bronze
	Malleable
	Heat Transfer
12:00 noon	Aluminum & Magnesium Round Table Luncheon
	Brass & Bronze Round Table Luncheon
2:00 p.m.	Technical Sessions
	Malleable
	Heat Transfer
	Educational
4:00 p.m.	Technical Sessions
	Brass & Bronze
	Aluminum & Magnesium
	Malleable
6:30 p.m.	Educational Dinner
8:00 p.m.	Technical Sessions
	Gray Iron Shop Course
	Sand Shop Course
	Brass & Bronze Sand Course

Tuesday, April 24

8:30 a.m.	Registration Opens
9:00 a.m.	Symposium on Gating and Risering
	(Jointly sponsored by Aluminum & Magnesium, Brass & Bronze, Gray Iron, Malleable and Steel Divisions)
12:00 noon	Malleable Round Table Luncheon
2:00 p.m.	Symposium on Gating and Risering
	(Continued)
4:00 p.m.	Technical Sessions
	Aluminum & Magnesium
	Pattern
	Sand
	Timestudy & Methods
7:00 p.m.	Canadian Dinner
8:00 p.m.	Technical Sessions
	Gray Iron Shop Course
	Sand Shop Course
	Brass & Bronze Sand Course

Wednesday, April 25

9:00 a.m.	Registration Opens
10:00 a.m.	Technical Sessions
	Brass & Bronze
	Gray Iron
	Sand
	Cost
12:00 noon	Pattern Round Table Luncheon
2:00 p.m.	Annual Business Meeting
2:45 p.m.	Charles Edgar Hoyt Annual Lecture
4:00 p.m.	Technical Sessions
	Refractories
	Plant & Plant Equipment
	Sand
7:00 p.m.	A.F.S. Alumni Dinner
8:00 p.m.	Technical Sessions
	Plant & Plant Equipment
	Gray Iron Shop Course
	Sand Shop Course

Thursday, April 26

9:00 a.m.	Registration Opens
10:00 a.m.	Technical Sessions
	Gray Iron
	Steel
12:00 noon	Gray Iron Round Table Luncheon
	Steel Round Table Luncheon
2:00 p.m.	Technical Sessions
	Gray Iron
	Steel
4:00 p.m.	Technical Sessions
	Gray Iron
	Steel
7:00 p.m.	Annual Banquet

program with sessions at 10:00 a.m., 2:00 p.m. and 4:00 p.m. on Monday, April 23. On Tuesday, April 24, the Division will participate in the first half of the *Symposium on Gating and Risering* in the morning, followed by the Malleable Round Table Luncheon, and will conclude its two-day program with the afternoon session of the gating and risering symposium.

Educational Division will begin its program with a technical session the afternoon of April 23, followed by the annual Educational Dinner at 6:30 p.m. that evening. The morning technical session will be divided into two topics: (1) Industry—*"Apprentice Training,"* and (2) Education—*"Trade School."* Again at the Educational Dinner, two talks will be featured: (1) Industry—*"Absorbing the Technical Trainee,"* and (2) Education—*"Developing Students for Industry."*

Scheduled for the Gray Iron Division on Monday, April 23, the first of three Gray Iron Shop Courses, will be devoted to *"Air in the Cupola."* Held in the evening, these courses are open to all local foundrymen as well as Convention attendants without charge. The Division's program will get into full swing with participation in the *Symposium on Gating and Risering* the morning and afternoon of Tuesday, April 24. Concluding the program for the day will be a Gray Iron Shop Course session on *"Melting Iron in a Reverberatory Type Furnace."*

On April 25 the Gray Iron Division has scheduled a technical session at 10:00 a.m. and the final Gray Iron Shop Course, on *"Metal Pouring Temperature Control,"* in the evening. Concluding the Division's program will be one morning and two afternoon technical sessions and the Gray Iron Round Table Luncheon.

Sand Division will launch its Convention program with the first of three Sand Shop Courses, open to all foundrymen, Monday evening, April 23. First Sand Division technical session will be held at 4:00 p.m., Tuesday, April 24, following the *Symposium on Gating and Risering.* At 8:00 p.m. the second Shop Course will be held. Final day's program will consist of technical sessions Wednesday morning and afternoon, April 25, and the last Sand Shop Course in the evening.

Steel Division's program will begin with participation in the *Symposium on Gating and Risering* the morning and afternoon of Tuesday, April 24. Next event on its schedule will be a technical session the morning of Thursday, April 26, followed by the Steel Round Table Luncheon and two more technical sessions in the afternoon, concluding its program.

Pattern Division will launch its Convention technical program with a session at 4:00 p.m., Tuesday, April 24. Second and final Divisional event will be the Pattern Round Table Luncheon, April 25.

Meetings of general foundry interest will begin with morning and afternoon sessions on Heat Transfer on Monday, April 23. On Tuesday, April 24, the Timestudy & Methods Committee will hold a session at 4:00 p.m.; the A.F.S. Foundry Cost Committee a session at 10:00 a.m., April 25, the Plant & Plant Equipment Committee afternoon and evening sessions on April 25, and the A.F.S. Refractories Committee a session at 4:00 p.m., Wednesday, April 25.

Scheduled Convention highlights include the Canadian Dinner at 7:00 p.m., Tuesday, April 24; the Annual Business Meeting of A.F.S. at 2:00 p.m., Wednesday, April 25, followed by the Charles Edgar Hoyt Annual Lecture, and at 7:00 p.m. the A.F.S. Alumni Dinner (by invitation only). Concluding the Convention will be the A.F.S. Annual Banquet.

Members of A.F.S. Western New York Chapter, hosts to the 1951 A.F.S. Convention, named to the chairmanships of Convention Committees are:

General Convention Committee

Chairman: Alfred A. Diebold, Atlas Steel Casting Co.
Vice-Chairman: Erwin W. Deutschlander, Worthington Pump & Machinery Corp.
Secretary: Roger E. Walsh, Hickman, Williams & Co.
Treasurer: M. W. Pohlman, Pohlman Foundry Co.

Reception Committee

Chairman: Keith Williams, Pratt & Letchworth Co.
Vice-Chairman: Henry F. Sproull, A. P. Green Fire Brick Co.

Ladies Entertainment Committee

Honorary Chairman: Leo A. Merryman, Tonawanda Iron Div., American Radiator & Standard Sanitary Corp.
Chairman: Mrs. John R. Wark.
Co-Chairman: Mrs. Alfred A. Diebold.

Plant Visitation Committee

Chairman: Joseph H. Sander, Tonawanda Electric Steel Casting Corp.
Co-Chairman: Walter Hunsicker, Worthington Pump & Machinery Corp.
Co-Chairman: Robert Bruce, Blaw-Knox Co., Buffovak Equipment Division.

Banquet Committee

Chairman: Avitus J. Heysel, E. J. Woodison Co.
Co-Chairman: Robert Young, Lumen Bearing Co.

Publicity Committee

Chairman: Marvin Taublieb, Frederic B. Stevens, Inc.
Co-Chairman: George A. Knowles, George A. Knowles Foundry, Inc.

Shop Course Committee

Chairman: Otto V. Guenther, New York State School of Applied Arts & Sciences.
Co-Chairman: Joseph M. Clifford, Bison Castings Co.
Co-Chairman: William H. Oliver, American Radiator & Standard Sanitary Corp., Bond Plant.

Solicitation Committee

Chairman: Arthur W. Murray, Bison Castings Co.
Co-Chairman: Leonard Greenfield, Samuel Greenfield Company, Inc.
Secretary: Carl A. Harmon, Hanna Furnace Corp.
Treasurer: M. W. Pohlman, Pohlman Foundry Co.

Transportation Committee

Chairman: Joseph Zahm, Master Pneumatic Tool Co.
Co-Chairman: Lynford C. Roberts, Combined Supply & Equipment Co.

MEMBERS PUSH BUILDING FUND UP OVER $60,000

APPOINTMENT of the A.F.S. Housing Committee, as announced in the December issue of American Foundryman, developed immediate increased support of the Society's program to acquire a permanent National Headquarters. As a result, the Building Fund reached $60,000 before the calendar year closed.

Under chairmanship of A.F.S. Past President Ralph J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., the other 15 members of the committee have personally contacted some 200 of the most influential members of the foundry industry.

All donors who have pledged to the Fund for a three-year period have now been invoiced for their 1950-51 contributions. At the same time, A.F.S. requests that members desiring to become Charter Subscribers do so promptly—mailing pledges or contributions to The Secretary, American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill.

Pledges and contributions received since publication of a combined list in the December issue are:

CHARTER SUBSCRIBERS

(November 30-December 31, 1950)

Pledges of Individuals

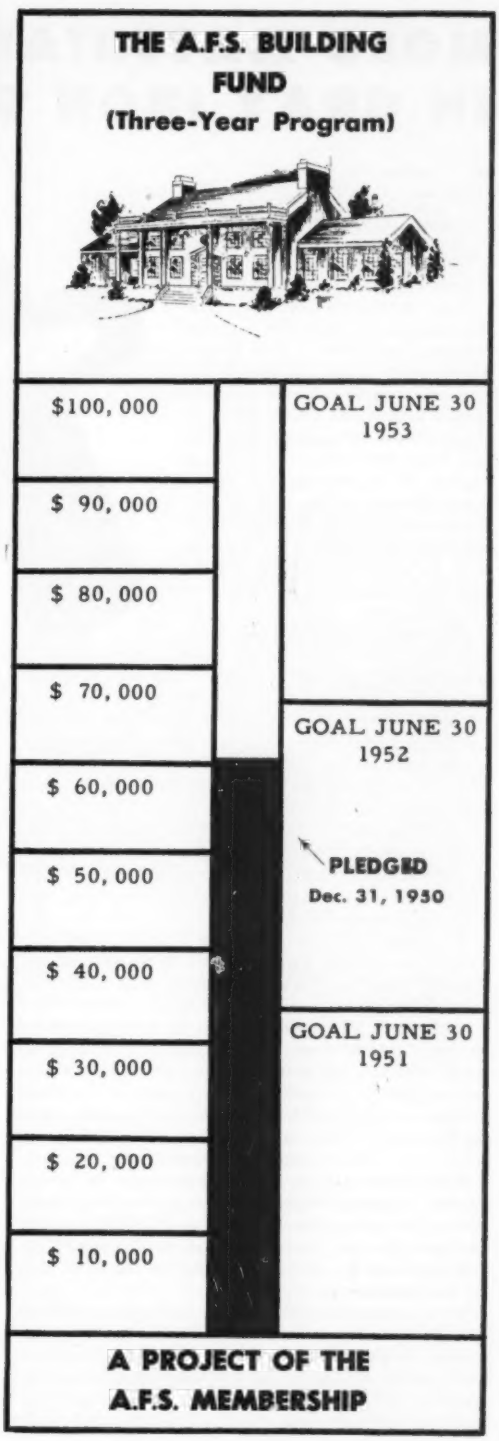
Herman C. Aufderhaar, Electro Metallurgical Div., Union Carbon & Carbide Corp., Chicago.
J. E. Gitzen, Delta Oil Products Co., Milwaukee.
William Kerber, Hanna Furnace Corp., Detroit.
Harry E. Lees, Whitin Machine Works, Whitinsville, Mass.
Dr. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.
Charles R. Marshall, Industrial Foundry Supply Company, San Francisco.
Chester V. Nass, Beardsley & Piper Division, Pettibone Mulliken Corp., Chicago.
John A. Rassenfoss, American Steel Foundries, East Chicago, Ind.
Peter E. Rentschler, Hamilton Foundry & Machine Company, Hamilton, Ohio.
A. G. Storie, Fittings, Ltd., Ottawa, Ont., Canada.
Sheldon V. Wood, Minneapolis Electric Steel Castings Company, Minneapolis, Minn.
W. V. Tiscornia, Auto Specialties Mfg. Co., St. Joseph, Mich.

Pledges of Companies

Acme Foundry & Machine Co., Coffeyville, Kansas.
Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago.
Carondelet Foundry Co., St. Louis.
Continental Gin Co., Birmingham, Ala.
Crouse-Hinds Co. of Canada, Ltd., Toronto, Ont., Canada.
Draper Corp., Hopedale, Mass.
Falk Corporation, Milwaukee.
Fittings, Ltd., Ottawa, Ont., Canada.
Goebig Mineral Supply Co., Chicago.
Harnischfeger Corp., Milwaukee.
Herman Pneumatic Machine Co., Pittsburgh.
Hoosier Iron Works, Kokomo, Ind.
Martin Engineering Co., Kewanee, Ill.
Tabor Manufacturing Co., Philadelphia.

Pledges of A.F.S. Chapters

Canton District Chapter
Chicago Chapter
Central Illinois Chapter
Central New York Chapter
Western New York Chapter



MOLD MATERIALS ARE FACTORS IN GRAY IRON SHRINKAGE

W. F. Bohm
Metallurgist
Buick Motor Co., Div. GMC
Flint, Mich.

This paper was presented at the Gray Iron Round Table Luncheon of the A.F.S. 54th Annual Meeting, at Cleveland, May 8-12, 1950, as part of the discussion on the effect of mold materials on metal shrinkage. Another part, covering an investigation conducted at Michigan State College, East Lansing, Mich., by C. A. Sanders and C. C. Sigerfoos, will appear in the February, 1951 issue of AMERICAN FOUNDRYMAN.

ONE OF THE MOST AGGRAVATING casting defects to the gray iron metallurgist has been the so-called "shrink" or "draw." It is known also by other names but the specific type of cavity this discourse is concerned with is characterized by: (1) fairly smooth surface; no dendrites nor "pine tree" effect; (2) usually located in a comparatively heavy section on the upper cope surface (it may be located somewhere farther down in the mold at a hot spot slow to solidify); and (3) usually contains "beads" or "shot" of eutectic metal.

Fig. 1—The cylindrical test casting is 1 in. in diameter and 2 in. high.

This particular defect has been aggravating to the metallurgist since the cause of the defect invariably has been ascribed to the metal and the metal alone. Despite lack of acceptable evidence in its support this feeling has been prevalent even to the present day. Recently, however, it has been shown conclusively that mold materials can determine whether or not this defect will occur (article by C. A. Sanders and C. C. Sigerfoos to appear in Feb., 1951, issue of AMERICAN FOUNDRYMAN). The exact mechanism by which mold materials control shrinkage of the aforementioned type has not been conclusively demonstrated.

The theory has been suggested by Sigerfoos and Womochel (A.F.S. TRANSACTIONS, 1940, vol. 48, pp. 591-622) that mold wall movement is probably the controlling factor insofar as the mold material effect is concerned. They propose that in a critical period during the early stages of solidification, after all gates have solidified and feeding ceases, the mold wall deforms slightly, permitting an expansion of the metal surface in contact with it. As a result the molten iron at the heavy sections and hot spots actually sinks to fill in the added volume thus created.

The following paper is a progress report of investigations currently being carried on at the GMC Buick Motor Div. gray iron foundry in an effort to shed further light on the influence of mold material on shrinkage and to further substantiate the mold wall movement concept.

Serious work along these lines was begun in 1947 by Harold S. Austin (retired), then Buick foundry metallurgist. At this time, after a prolonged investigation, a simple cylindrical casting was adopted as a test casting (Fig. 1). The cylinder is 1 in. in diameter and 2 in. high, cast with the long axis vertical and gated at the top with two knife gates, 1/16 in. deep by 1/4 in. wide. It was found that this small casting would fully exhibit all the shrinkage behavior characteristic of production castings. At the same time it was such a simple casting to make that a very large number of variables, such as sand mixtures, could easily be checked.

The results of these studies established qualitatively the effects of clay content, base sand, sea-coal content, wood flour, organic material, moisture, ramming, metal composition, etc., on shrinkage, and provided the background for the following efforts at quantitative evaluation.

The basic experiment consisted of molding the 1-in. cylinder or "slug" under controlled conditions, pouring the mold with induction furnace iron, and then measuring slug diameter and ensuing cavity.

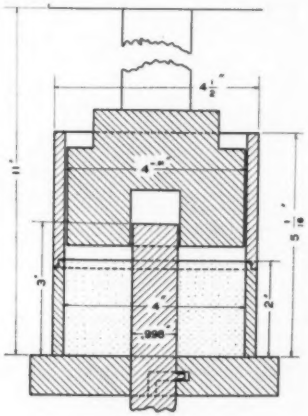


Fig. 2—Sketch showing details of the constant volume molding equipment used to produce uniform test molds.

Molding Conditions: The mold consisted of a baked oil-sand cope which contained the gating system; a flat, baked, oil-sand drag; and a cheek section with

the slug cavity. Molding equipment is illustrated in Fig. 2. For each sand mixture tested, a standard 2-in. specimen was first rammed and a density value established. The equivalent quantity of sand was then vibrated in the constant volume flask, and a fitted piston lowered from above to squeeze the sand to a constant height of 2 in. Hardness checks indicated a very uniform mold to be produced in this fashion.

The slug pattern was ground to a fine finish, 0.998 in. in diameter, with no draft. Base sand used in each case was a Michigan bank sand of A.F.A. Grain Fineness 80. The use of this type sand made it possible to obtain surface finishes clean enough to permit accurate micrometer measurements after only a superficial grit blasting.

Melting Conditions: Induction furnace iron was used in each case of the present study. Synthetic pig and scrap composed the base charge, producing an iron of the following percentage composition: C, 3.45-3.60 per cent; Si, 2.45-2.60; Mn, 0.75-0.85; P, 0.070-0.090; S, 0.12-0.14. Current was cut off at 2800 F, followed by inoculation with calcium-silicon and synthetic graphite, and the heat then poured. The low phosphorus diminished somewhat the quantity of liquated metal and made it easier to clean the draw cavity and measure its true initial volume.

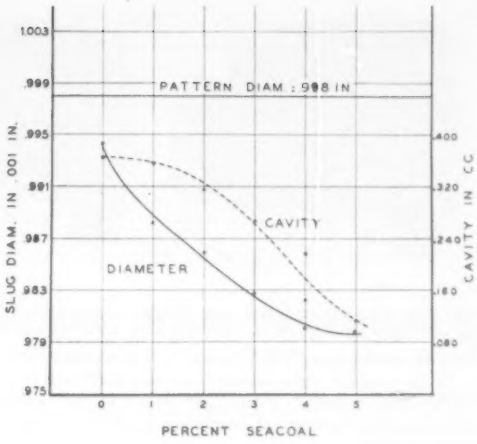


Fig. 5 (above, right)—Various additions of sea coal to sand mixtures containing 6 per cent southern bentonite effect both cavity and diameter reductions in castings.

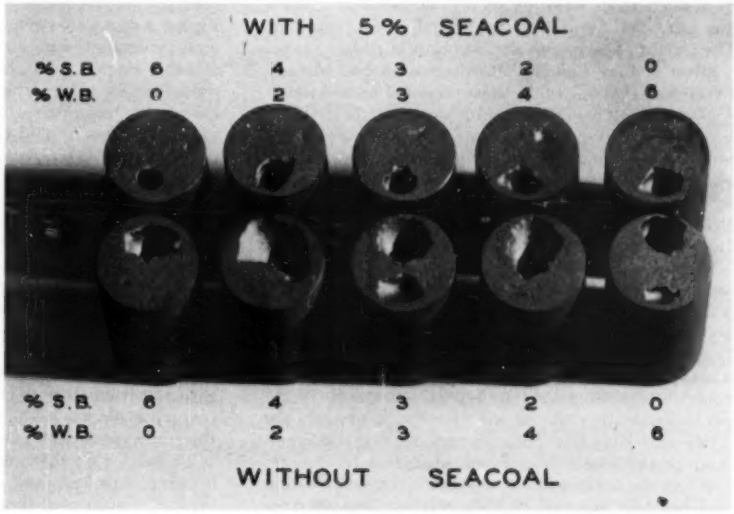
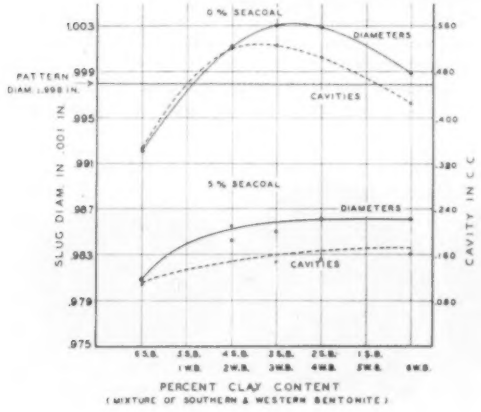


Fig. 4 (right)—Addition of 5 per cent sea coal to the molding sand mixture tends to diminish the effects of the type of clay used.

Fig. 3 (below)—Graphs showing the effects of various combinations of southern and western bentonites on diameters of test castings.



Physical Measurements: On the basis of several hundred previous tests made at Buick using this basic slug it became apparent that a definite difference in overall dimensions existed between "drawn" and "undrawn" slugs. The measurements were rather crudely made, but a persistent difference was noticed nevertheless. Invariably the drawn slug showed larger diameters than sound slugs.

This observation was confirmed under actual production conditions. Buick automotive valve lifters are cast as solid cylinders, approximately 1 in. in diameter and 2½ in. long. Measurements of the di-

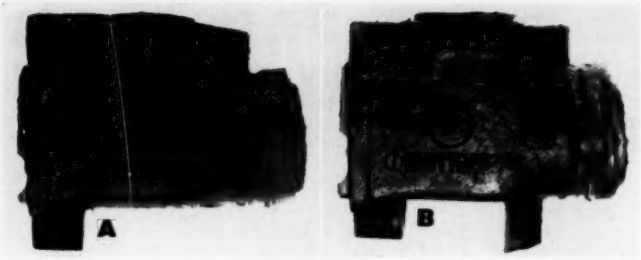


Fig. 6—Two valve body castings were made in the same mold from the same ladle of iron. Casting (A), made in line sand, has a deep cavity in the boss (upper left-hand corner). Casting (B), made in sand containing southern bentonite and sea coal, is sound.

ameters of sound and drawn lifters cast over a period of several weeks revealed the drawn lifters to possess an average diameter 0.007 in. larger than sound lifters.

In the current experiment each test slug was first lightly grit blasted with fine grit and then measured with micrometers on 10 diameters at the mid-point of the length.

Cavities were lightly cleaned with burring tools and then filled to overflowing with carnauba wax. Excess was filed off to conform to original casting contour. The weight of carnauba wax was translated to volume.

Effect of Clay Content: Previous work had already established that one of the most potent factors in molding sand which would determine shrinking or drawing tendency is the type and amount of bonding clay used. Southern bentonite, for example, is a type of clay which definitely exhibits a tendency to reduce shrinkage. Western bentonite, on the other hand, seems to promote shrinkage. Figure 3 illustrates graphically the results of an experiment which shows this effect.

Various combinations of the two clays, with and without sea coal, were made into the precision slugs and measured as previously described. The upper two curves, representing the mixtures without sea coal, show that with all southern bentonite as the bonding clay the slug with the smallest cavity and the smallest diameter is produced. As the southern bentonite in the mix is gradually replaced with western bentonite, the cavity and diameter both increased to a maximum value represented by 3 per cent of each.

When the same series is repeated with the addition of 5 per cent sea coal to each mixture, the effect of clay type is diminished to quite some extent. The curves flatten out and for each mixture the cavity and diameter is reduced. Figure 4 shows the appearance of this series.

Effect of Sea Coal: To illustrate further the effects of sea coal, a series was run using 6 per cent southern bentonite as the base clay, adding various amounts of sea coal. Figure 5 shows the strong effect of each added percentage in reducing both cavity and diameter. Actually, with a normal small-parts cupola iron and a 5 per cent sea coal addition, the southern bentonite slug can be made 100 per cent sound.

This basic experiment, using the cylindrical slug, establishes quite clearly that a mold wall movement is involved in the appearance of this shrinkage defect. Figure 3 shows that the maximum difference in diameters measured was about 0.022 in. Offhand, this amount sounds quite insignificant. However, if the difference in volume between these two cylinders is calculated, assuming the diameter to be the only significant dimensional change, the result is a volume of 1.149 cc, a cavity large enough to scrap most castings. In practice, this magnitude of cavity did not develop, undoubtedly due to some feeding.

The point to be emphasized from this dimensional study is the fact that shrinkage of this type is definitely associated with a change in the casting dimensions. Obviously, with metal conditions kept constant, as they were in this work, this dimensional change must have been influenced by mold material. The details of just how such a movement is brought about are rather obscure. There is the strong inference to be gathered from these data that some physical sand test involving deformation could be devised to evaluate this movement and predict shrinkage behavior.

To show that this intimate relationship does exist between shrinkage and mold material, two examples typical of numerous similar tests are offered. Figure 6 shows two automotive, exhaust-manifold, valve bodies. Both were cast in the same mold, gated the same way, and poured from the same ladle of iron through a common sprue.

Casting *A* was made with line sand which at that time was giving some difficulty with shrinkage. Cast-

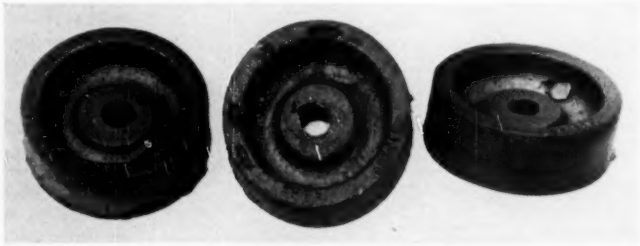


Fig. 7—Three experimental castings made from the same ladle of iron in the same base sand except that the sound casting at the left had a 3 per cent sea-coal addition to the base sand.

ing *B*, however, was made with a sand of the following composition: sharp sand, 60.0 per cent; bank sand, 27.5; southern bentonite, 4.5; fire clay, 2.75; western bentonite, 0.25; sea coal, 5.00.

It is observed that casting *A* shows a deep cavity in the boss at the upper left-hand corner. Casting *B*, poured from the same ladle of iron, is perfectly sound.

Figure 7 illustrates this defect present in an experimental casting being made on the jobbing floor. All three castings were made from the same facing sand and poured from the same ladle of iron. The sound casting at the left, however, was made with an added 3 per cent sea coal to the base sand. It is of interest to note that the sound castings from this lot average 0.007 to 0.015 in. smaller on the outside diameter than castings with cavities.

It is by no means to be inferred from the above work that sand composition is the only factor involved in this type of shrinkage. Metal composition, for example, has been established qualitatively to effect shrinkage. Further work is being done at present at Buick to evaluate metal effect as well as such other variables as moisture, ramming, and organic content, using the slug method outlined.

ANNOUNCE WISCONSIN, BIRMINGHAM REGIONALS

TWO OF THE OLDEST regional foundry meetings will provide foundrymen of the North and the South with an opportunity to compare production problems and solutions in February. Scheduled for February 8 and 9 at the Schroeder Hotel, Milwaukee, is the Wisconsin Regional Foundry Conference, sponsored by the Wisconsin Chapter and the University of Wisconsin. The Birmingham Regional Foundry Conference will be held February 22, 23, and 24 at the Tutwiler Hotel, Birmingham, Ala.

Chairman of the Wisconsin Regional is George E. Tisdale, Zenith Foundry Co., Milwaukee. Morris L. Hawkins, Stockham Valves & Fittings, Birmingham, Ala., is chairman of the Birmingham Regional, sponsored by the Birmingham District Chapter, the University of Alabama, and the A.F.S. Student Chapter at the university.

Third regional foundry gathering of early 1951 will be the Ohio Regional Foundry Conference headed by Stephen E. Kelly, Eberhard Mfg. Co., Cleveland. Details and complete program will appear in the February issue of AMERICAN FOUNDRYMAN.

WISCONSIN REGIONAL CONFERENCE

Advance registration for the Wisconsin Regional Foundry Conference—$10.00 for the full conference—can be made through Leon H. Decker, Foundry Div., Allis-Chalmers Mfg. Co., West Allis 14, Wis., chapter treasurer. Preview of the program shows the following sessions:

Thursday, February 8

9:00 a.m.—REGISTRATION.

10:00 a.m.—WELCOMING ADDRESSES. Dean M. O. Withey, University of Wisconsin, and A.F.S. National President Walton L. Woody.

12:00 noon—LUNCHEON. Speaker to be announced.

2:15 p.m.—SECTIONAL MEETINGS.

Steel—*"Gates and Risers,"* J. B. Caine, Cincinnati.

Gray Iron—*"Cupola Operation with High Scrap Mixture,"* A. J. Busch, Chas C. Kawin Co., Chicago.

Malleable—*"High Speed Grinding in the Malleable Foundry,"* A. S. Takestraw, Norton Co., Milwaukee.

Non-Ferrous—*"What's Wrong in Your Cleaning Room?"* V. W. Nichols, Vapor Blast Co., Representative of Chicago Pneumatic Tool Co.; B. H. Work, Carborundum Co.; and T. G. Bair, Fox Grinders, Inc.

Pattern—*"Patterns Required for the Croning Process,"* J. Klement, Ampco Metal, Inc.

4:00 p.m.—SECTIONAL MEETINGS.

Steel—*"Metal Penetration in Steel Castings,"* S. L. Gertsman, Dept. of Mines and Technical Surveys, Ottawa, Ont., Canada.

Gray Iron—*"Fluidity Testing of Gray Iron Castings,"* P. C. Rosenthal, University of Wisconsin.

Malleable—*"Dielectric Core Baking,"* Representative of Allis-Chalmers Mfg. Co.

Non-Ferrous—*"Mechanization of the Small Jobbing Foundry,"* L. G. Probst, National Engineering Co., Chicago.

Pattern—*"Foundryman's Attitude Toward Pattern Equipment,"* George Antonic, Motor Castings Co., Milwaukee.

6:30 p.m.—BANQUET. Speaker to be announced.

Friday, February 9

10:00 a.m.—SECTIONAL MEETINGS.

Steel—*"Riser Compounds,"* H. F. Taylor, Massachusetts Institute of Technology.

Gray Iron—*"Scrap Castings Due to Sand Defects,"* George W. Anselman, Beloit Foundry, Co., Beloit, Wis.

Malleable Iron—*"Do You Believe Your Molding Sand Can Affect Your Casting Shrinkage?"* Clyde A. Sanders, American Colloid Co., Chicago.

Non-Ferrous—*"Faster and More Efficient Melting,"* J. G. Winget, Reda Pump Co., Bartlesville, Okla.

Pattern—*"Value of Patternmaking to Modern Casting Engineering,"* J. Anderes, Belle City Malleable Iron Co., Racine, Wis.

12:00 noon—LUNCHEON. Speaker to be announced.

2:30 p.m.—SECTIONAL MEETINGS.

Steel—*"Repair Welding of Steel Castings,"* J. D. Wozny, American Steel Foundries, East Chicago, Ind.

Gray Iron—*"The Modern Foundry—Design, Operation, and Maintenance,"* E. E. Ballard, Lester B. Knight & Associates, Chicago.

Malleable Iron—*"Malleable Annealing,"* R. Schneidewind, University of Michigan.

Non-Ferrous—*"Exothermic Riser Compounds,"* J. O'Keefe, Jr., Exomet, Inc., Conneaut, Ohio.

Pattern—*"Demonstration Drag and Cope Dual Production,"* A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee.

BIRMINGHAM REGIONAL CONFERENCE

Program for the 19th Birmingham Regional Foundry Conference follows. All day Saturday, February 24, is available for plant visitation.

Thursday, February 22

10:00 a.m.—REGISTRATION.

11:00 a.m.—OPENING SESSION. *"Foundry Developments as General Motors Sees Them,"* L. A. Danse, General Motors Corp., Detroit.

12:30 p.m.—LUNCHEON. Speaker to be announced.

2:30 p.m.—*"Engineering Properties of Gray Iron for Foundrymen,"* T. E. Eagan, Cooper-Bessemer Corp., Grove City, Pa.

6:00 p.m.—BANQUET. Speaker: R. L. Lee, General Motors Corp., Detroit.

Friday, February 23

9:00 a.m.—PLANT VISITATIONS.

12:30 p.m.—LUNCHEON. Speaker to be announced.

2:30 p.m.—*"Studies on Improvement of the Machineability of High Phosphorus Gray Iron,"* Wm. W. Austin, Southern Research Institute, Birmingham, Ala.

4:00 p.m.—*"Fluid Flow,"* A.F.S. new color-sound movie on Society-sponsored gating research.

7:00 p.m.—ENTERTAINMENT.

W. L. Seelbach

NOMINATE

I. R. Wagner

1951-52 OFFICERS AND DIRECTORS

WALTER L. SEELBACH, president and general manager, Superior Foundry, Inc., Cleveland, was nominated 1951-52 President of American Foundrymen's Society, heading the slate of 1951-52 National Officers and Directors of the Society, at a meeting of the A.F.S. Nominating Committee, held December 15 in Chicago. Nominated to succeed Mr. Seelbach as National Vice-President of A.F.S. is I. R. Wagner, director, Electric Steel Castings Co., Indianapolis.

A.F.S. Director nominees to serve three-year terms beginning in 1951 are:

Martin J. O'Brien, Jr., works manager, Symington-Gould Corp., Depew, N. Y.

Harry W. Dietert, president, Harry W. Dietert Co., Detroit, Mich.

Albert L. Hunt, works manager, National Bearing Division, American Brake Shoe Co., St. Louis.

Dr. James T. MacKenzie, technical director, American Cast Iron Pipe Co., Birmingham, Ala.

A. M. Ondreyco, plant manager, Vulcan Foundry Co., Oakland, Calif.

Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, whose term as A.F.S. National President expires in 1951, will continue as a National Director of A.F.S. for one year.

Election of officers and directors will take place during the Annual Business Meeting of the Society, to be held during the 55th National Convention of A.F.S. in Buffalo, April 23-26, 1951. These officials of the Society will take office immediately following the annual meeting of the Board next July.

National Directors who will complete their three-year terms this July are:

T. H. Benners, Jr., T. H. Benners & Co., Birmingham, Ala.

Norman J. Dunbeck, vice-president, Eastern Clay Products, Inc., Jackson, Ohio.

Robert Gregg, foundry manager, Reliance Regulator Division, American Meter Co., Alhambra, Calif.

Victor E. Zang, vice-president in charge of research and development, Unitcast Corp., Toledo, Ohio.

Martin J. O'Brien, Jr., works manager, Symington-Gould Corp., Depew, N. Y., who for the past year has filled the unexpired term of the late Alfred M. Fulton, Northern Malleable Iron Co., St. Paul, Minn., has been nominated to serve a three-year term as A.F.S. National Director beginning in 1951.

Nominations for officers and directors of A.F.S. for election at the 1950 Annual Business Meeting are announced in accordance with the By-Laws which require that the report of the Nominating Committee be published at least 60 days prior to the Meeting. Thereafter and at any time 45 days prior to the date of the Annual Business Meeting additional nomina-

A. M. Ondreyco

J. T. MacKenzie

A. L. Hunt

M. J. O'Brien, Jr.

tions may be made by written petition filed with the secretary of the Society and signed by 35 members in good standing.

Should no candidates be nominated by petition, the secretary *"shall, at the annual Business Meeting, cast the unanimous ballot of all members for the election of the candidates named in the report of the Nominating Committee, and as published to the membership"* as prescribed by the By-Laws. If additional candidates are nominated by petition, the By-Laws require that elections shall be by letter ballot.

The seven members of the Nominating Committee, in addition to the two Immediate Past Presidents of the Society, are chosen by the Executive Committee of the Board of Directors from lists of candidates submitted by the various eligible chapters. One member of the Nominating Committee may be from the list of members in the United States, Canada and Mexico

Walton L. Woody

H. W. Dietert

not residing in a chapter area. A chapter is not eligible to have a member on the committee if represented during the previous two years. Two candidates for the Nominating Committee are submitted to the National President of A.F.S. prior to July 1 of each year by the eligible chapter.

Continuing National Directors of the American Foundrymen's Society are:

(Terms expire in 1952)

Thomas E. Eagan, chief metallurgist, Cooper-Bessemer Corp., Grove City, Pa.

Lloyd C. Farquhar, Sr., works manager, American Steel Foundries, East St. Louis, Ill.

Vincent J. Sedlon, president, Master Pattern Co., Cleveland.

Fred G. Sefing, metallurgist, International Nickel Co., New York.

L. D. Wright, plant manager, United States Radiator Corp., Geneva, N. Y.

(Terms expire in 1953)

J. J. McFadyen, general manager, Galt Malleable Iron Co., Galt, Ont., Canada.

J. O. Ostergren, president, Lakey Foundry & Machine Co., Muskegon, Mich.

Frank W. Shipley, foundry manager, Caterpillar Tractor Co., Peoria, Ill.

James Thomson, chief engineer, Continental Foundry & Machine Co., East Chicago, Ind.

E. C. Troy, foundry consultant, Palmyra, N. J.

A.F.S. 1951 Apprentice Contest Hits Stride As Several New Plants Enter

NOW IN FULL STRIDE with the entry of several new plants, the 28th Annual A.F.S. Apprentice Contest again promises to attract the nation's top apprentice patternmakers and molders, who will compete for cash awards and a trip to the 1951 A.F.S. Convention in Buffalo, April 23-26.

During the Convention's Annual Business Meeting, A.F.S. National President Walton L. Woody will award certificates and $100 to first prize winners in each of the five contest divisions—Gray Iron Molding, Steel Molding, Non-Ferrous Molding, Wood Patternmaking and Metal Patternmaking. These winners will also have their round trip rail and Pullman fare paid to and from the Convention. Second prizes of $50 each and third prizes of $25 each will be awarded runners-up in each Division in appropriate A.F.S. chapter or plant ceremonies.

Now in its 28th year, the contest is open to all apprentices in the United States, Canada, and Mexico who are taking a regular course of training of not less than three years' duration. Contestants may not be over 24 years old on the day they prepare their entries; veterans' age limit is 24 plus length of service in the Armed Forces.

The 1951 A.F.S. Apprentice Contest opened September 15 and will conclude March 1 with national judging planned for March 24 in Buffalo. This year for the first time judges will observe a new regulation which states that in each division "entries must be salable castings and patterns, and to qualify for prizes, the first prize winner must rate a score of 88 points minimum, the second prize winner 85 points minimum, and the third prize winner 76 points minimum."

Complete information on the contest can be obtained by writing to Jos. E. Foster, Technical Assistant, American Foundrymen's Society, 616 S. Michigan, Chicago 5, Ill. In addition to regulations, A.F.S. Headquarters supplies patterns for the molding divisions, blueprints for wood patternmaking, and rough aluminum castings and blueprints for metal patternmaking.

Those chapters and plants who are now in possession of contest molding patterns are requested to return them to Mr. Foster at A.F.S. Headquarters as soon as they have finished with them, since these patterns are needed by other contestants.

Apprentices may enter the A.F.S. Apprentice Contest as individuals or through a plant or chapter contest. In addition to a number of individual entries, the national judging will include winners of contests held by the St. Louis District and the Wisconsin chapters, and by Caterpillar Tractor Co., Peoria, Ill., and Textile Machine Works, Reading, Pa. The three Canadian chapters are also expected to enter.

Companies and individuals who have contributed time and materials to the 1951 Contest are: Vaughan C. Reid, City Pattern & Foundry Co., Detroit (rough castings); George E. Garvey, City Pattern & Foundry Co., South Bend, Ind. (aluminum patterns); F. W. Burgdorfer, Missouri Pattern Works, St. Louis (pattern drawings, rough casting patterns and wood patterns); and Caterpillar Tractor Co., Peoria, Ill. (shipping boxes).

Excerpted from the 1950 Exchange Paper of the Institute of Australian Foundrymen to the American Foundrymen's Society, this article describes the present status of the ferrous foundry industry in Australia—an industry that started in 1833 with the opening of a shop in Sydney. Prepared by a sub-committee of the Sydney branch of the New South Wales Division of the Institute of Australian Foundrymen, this article is the work of New South Wales Division President T. Watson and Division Councillors K. Spencer, A. T. Batty, and W. Dummett.

GENERALLY SPEAKING, almost any Australian foundry would find its counterpart in the United States—some are efficient, others not quite so efficient. Many have up-to-date equipment, while others rely largely on manpower for their production. The one great difference between the Australian and American casting industries is in the size of the foundries, most Australian foundries being considerably smaller than those in the United States.

It is possible to produce any type of ferrous casting in Australia, which has some 400 ferrous foundries. Of these, 20 cast steel, seven produce malleable iron, and the balance cast gray iron. About 200 foundries produce castings solely for the engineering needs of their own firms, while 75 make castings partially to meet their own engineering requirements. The remaining 125 foundries are in active competition for ferrous castings required by engineering firms not operating their own foundries.

The approximate amount of metal melted in a year by these 400 foundries is 325,000 tons, divided as follows: electric steel, 55,000 tons; open hearth and converter steel, 17,000 tons; malleable iron, 10,000 tons; and gray iron, 243,000 tons.

Calculating average casting recovery as 60 per cent for steel and malleable iron foundries and 75 per cent for gray iron shops, the yearly quantity of castings made in Australia would be: steel (all types), 43,000 tons; malleable iron, 6,000 tons; and gray iron, 182,000 tons—a total of 231,000 tons of castings produced annually in the Commonwealth of Australia.

Australian foundries produce all types of engines, including: air and water cooled gasoline and diesel types suitable for stationary or traction purposes; wet and dry liner tractor engines, oil burning or steam marine engines, and various types of turbine engine castings. Also produced are malleable iron pipe fittings and link chain, bicycle and automobile parts, sheep shearing equipment, and various odds and ends required by engineering firms.

Produce Wide Variety of Castings

All types of rolls are procurable in either hardened steel, chilled, or alloy iron. A choice of static or centrifugally-cast steel railway wheels is offered. It is possible to buy such Australian-cast steel hand tools as hammers, pliers, tailors' shears, axes and metal cutting plumbers' hand shears. These are sound castings— isothermally heat-treated, of good appearance and high quality. High duty plain and alloy irons up to 75,000 psi are available, as are heat resisting and stainless irons and steels.

Australia makes steel breakdown rolls up to 160,000 lb, stern frames for ships, dredge buckets and tumblers, crushers, compressors, cast iron and steel crankshafts, machine tool castings, gas meters, hot water radiators, baths and sinks, pumps, precision cast dies and molds for drop-forging or glass molding, ornamental ironwork, sheaves, single-piece locomotive bogies, hydraulic press parts, etc.

Australian exports include farm machinery, engines, foundry machines, railway castings, dredge buckets,

hardware, electrical castings, ink and cereal rolls, presses, and machine tools. This market is on a competitive basis with those of many larger countries.

Wherever possible, the Australian foundryman is inclined toward specialization. This trend has become more pronounced during the last five years and today perhaps half-a-dozen concentrate on producing a particular type of casting, whereas 15 years ago the policy was for a foundry to attempt a wide range of manufacture.

This trend has resulted in a noticeable improvement in casting finish and performance and has automatically created an intensified urge to mechanize. Specialization and increased demand for castings simplifies the process of mechanization, particularly in the fields of engine castings, hollow ware, and malleable iron.

Sand Practices Vary Locally

However, there are problems created by entirely local conditions which often must be solved through methods purely local in origin. To illustrate, the general difference in technique between New South Wales and Victorian foundries in the use of molding and coremaking sands is clearly recognized in Australia. Sydney steel shops use synthetic sand almost exclusively. This sand is made from a type of sandstone, sometimes known as free-stone or rotten rock, bonded with dextrin and western bentonite.

Melbourne steel shops, because of an abundance of uniform, first-class natural sands, have developed the technique of using them to a high degree, using them for both green and dry molding.

Similarly, steel core making practice in the two states follows different methods. Sydney foundries almost exclusively use sharp or drift sand bonded with a green strength-imparting binder, while most Melbourne shops use loam, which imparts green strength, and add oil for more dry strength.

Direct-Arc Steel Melting Common

In the steel foundries of Australia, melting is generally done by the direct arc process. Most common furnace is the three-electrode, roof-charging automatic control type, melting 22,000 lb per heat and using 210 volts for melting down and 110 volts during refining. Some of the older installations have two electrodes and bottom contact, though no new installations of this type have been made during the past 10 years.

Founders making high-alloy steels such as stainless and heat-resisting types, have installed induction furnaces or rocking hearth indirect-arc furnaces to remelt foundry scrap. These units are acid lined, though one firm is experimenting with basic linings. Ninety per cent of Australia's direct-arc furnaces are operated with a basic lining, using the two-slag process and finishing with a semi-carbide falling slag. Acid furnaces are used by firms specializing in light repetition castings and are from 1500 to 3000-lb capacity.

Most steel shops are equipped with sand handling plants, consisting of shakeout, belt conveyors to hopper sand storage, mullers, and belt conveyors to hopper storage over molding machines.

Whereas 15 years ago the bulk of steel castings were made in dry sand molds bonded with crude dextrin or core gum and molasses and cast warm to prevent moisture absorption, today molasses has been almost entirely discarded as a binder. This has resulted in about 75 per cent of the steel castings being cast in green sand. Dry sand molds, once dried, can now be left to stand for weeks before casting. A typical green sand mixture for steel shops is: rotten rock (sandstone), 100 parts; western bentonite, 4 parts; dextrin, 1 part; water, 4 parts.

The use of silica flour is forbidden in Australia. As a consequence, zircon flour is largely used for mold and core washes, with a resulting improvement in casting finish on dry sand work and core faces. This material is available ready-mixed for either spraying or brushing, in both oven and air drying types. Powdered magnesite coatings are also widely used.

The bulk of annealing ovens are single-batch types fired by oil, coal gas, electricity, coke, or coal. Average capacity of these ovens is about four tons and the heating cycle, including heat-up, hold period and cooling, is 16 to 20 hr.

Large steel foundries have their own machine shops, forge shops, and drafting departments. Thus it is possible to buy railway bogie sets complete with axles, complete dredges, or a finished crusher direct from the foundry.

Metallurgical Controls Widely Practiced

Metallurgical control is effected by chemical and physical laboratories and sand testing equipment, and pilot plants are established in some foundries. Grain size control is becoming more popular, and the metallurgical microscope is in constant use. Routine investigation and research are sometimes carried on cooperatively by two or three foundries.

Gray iron shops may be grouped as specialty foundries and heavy and light jobbing foundries. Bulk of the gray iron is melted in cupolas with one notable exception—the casting of ingot molds at a steelworks direct from blast furnace hot metal. Most cupolas have a single row of tuyeres and are of the general proportions of the cupolas common in the United States. Foundries seeking fuel economy on long runs favor the BCIRA type balanced-blast cupola with one row of main and two rows of auxiliary tuyeres. More than 50 such cupolas have been made and installed in Australia.

The best cupola coke is supplied from New South Wales where practically all of the continent's bituminous coking coal is found. It is made by the beehive process and is of good quality from the viewpoints of physical properties and sulphur content. Its ash content, however, is consistently higher than 10 per cent and sometimes over 15 per cent, rendering difficulties in obtaining hot metal, particularly for small cupolas.

There are no iron shops in Australia comparable to the larger automobile set-ups in the U.S.A., but five or six making engine castings are comparable. The most modern are two completely mechanized foundries belonging to General Motors-Holdens Ltd., at Fisherman's Bend, Victoria, and the International Harvester Co., Geelong, Victoria. Several more or less highly mechanized shops are in existence handling a wider range of castings, and at least four more are planned, mainly for engine manufacture.

The General Motors plant includes jolt-squeeze ma-

chines, mold conveyor, pouring station, fume hood, shakeout, cooling rooms, and shot cleaning, and the castings reach the cleaning department before being touched by hand. Green sand molds, sprayed and torch dried are cored, assembled, and poured within half an hour of molding. Core blowing accounts for over 60 per cent of the core production and this will ultimately be raised to 90 per cent.

Cores are baked in batch type ovens, giving a maximum variation of 5 F in any part of the oven, baking cycle being 2¼ hours at 415 F, and by vertical conveyor oven. Cores are jigged before assembly, and maximum tolerance for assembly is under 0.010 in. over all. Metal is cupola melted, and superheated in a 7,000-lb electric furnace.

The International plant, besides making gray iron, also produces malleable iron, and is built on similar lines to the G.M. plant. Two main differences are mezzanine floor sand mixing and mono-melting. Other plants favor inclined roller conveyors between the molding bay and pouring bay.

Well-Equipped Jobbing Foundries

Heavy jobbing foundries are reasonably well equipped and about half function in conjunction with machine shops. All the prominent machine tool manufacturers, ship builders, and mining engineers have their own foundries with drafting room, pattern shop, and some metallurgical facilities.

Perhaps the most interesting section of the gray iron foundry group is the medium to small shop, whether jobbing or specializing in repetition work. There are at least eight of these shops to every large one, melting from 3 to 10 tons of metal a day.

Australian Foundries Usually Owner-Managed

Whether small private companies or individually or family owned, they are generally owner-managed, with family connections occupying key positions. Run solely as foundries, without machine shops, and often without any professional metallurgical control, other than some consulting link, they are strongly competitive and produce high ratios of daily output per molder, without substantial aid from mechanization, outside of molding machines.

Organized to operate on small quantities and short runs, flask and core-making equipment is not elaborate —in comparison to the large shops—more reliance being placed on the skill of the operator and closer supervision from executives to maintain casting quality and output.

Invariably heap sand molding is practiced, each molder being supplied with enough sand for a day's work in the vicinity of his machine or work place, supplemented by facing sand, supplied in barrow loads during the day as required. Molds are poured by the molders, knocked out by a night shift, the sand watered down roughly, sieved, and heaped ready for commencement of work next morning.

Usually these shops have several specialized lines, known as bread and butter lines, for which they have special equipment and make a small profit margin, in order to hold off competition. For example, one firm will make meter castings, another electrical motor castings, sheaves or pulleys, while pipes or shoe lasts or sewing machine parts will be the bread and butter line of some other.

It is definitely recognized by foundry equipment engineers that much could be done to mechanize these set-ups. Where the proprietors are amenable to plant improvement, it usually takes the form of an efficient sand mill, good core baking ovens, core blowing equipment, efficient molding machines, and in a few cases, hopper storage of backing sand. The bulk of these foundries use natural sand for molding, usually relying on the mill operator for its quality and surprisingly good results are obtained.

Manual Cupola Charging Prevails

Cupola charging is usually manual, most foundries having but one furnace, which is patched in the morning and operated from two to three hours in the afternoon, dropping of the bottom coinciding with knockoff for all day-shift hands. These shops cast the bulk of their work green, plate molders using tapered flasks and jackets, jobbing shops using cast iron flasks, dry facing with crude plumbago and talc in even amount whenever required.

Hollow ware manufacturers have complete plants, and are considered highly efficient and up-to-date. Their practice favors sand slinging which accounts for more than three-quarters of the local production, although the more recent installations are mostly bumper machines. Core blowing is used almost exclusively in some shops. Owing to shortages of coal, labor, and pig iron, Australia has been forced to import hollow ware and hardware to meet demands for new housing. Quality of local production is equal to that of the imported articles.

Malleable iron foundries are mostly larger than the average gray iron foundries. Because of the larger runs of specialized castings there is opportunity for more mechanization. A recent plant for Stewarts & Lloyds in South Australia is said to be among the most efficient and up-to-date in the world. Designed solely for the making of pipe fittings, the equipment includes complete sand and mold handling equipment, monomelting by cupola, core blowers, and air and steam controlled atmosphere annealing on the white heart process. Two other plants making fittings solely are now in the process of re-designing their set-ups to operate along similar lines.

Largest Malleable Plant Mechanized

Australia's largest general iron foundry is operated by Malleable Castings Ltd., Sydney, N.S.W. This firm has separate heavy and light gray iron foundries besides operating the largest general malleable iron plant in Australia. Re-designed in 1939, the latter has an overhead sand handling plant to machine hoppers, with molding stations placed around the sides of a square served by a monorail mold conveyor. All molds are poured on the conveyor from a pouring station with duplex melted metal from a cupola, superheated and equalized in an automatic stoker-fired air furnace.

After shakeout, castings are belt conveyed to the cleaning and finishing department, then belt conveyed to and through the inspection department. Annealing is carried out in a series of pack ovens operating on the

long cycle black heart process. This firm has been prominent for many years for its light castings production technique, particularly in pattern plate manufacture and many methods used by the trade generally can be established as having their origin there.

Foundry equipment is 90 per cent Australian made, and could be said to compare in quality to any similar plant on the world market. While some manufacturers, operating under license to prominent English and American equipment firms, keep themselves up to date by this arrangement, others maintain their own design and research sections, and have produced many machines with entirely Australian features. Consequently foundrymen have a full range from which to select.

Supplies of pig iron, coke, iron and steel scrap, and electric power are not sufficient to meet the demand continuously and some foundries experience periods of acute shortage for several weeks. American western bentonite is most popular for synthetic sand bonding, and supply, because of dollar import restrictions, barely meets present demand. This has had the effect of slowing down the further development of synthetic sand usage.

Core oils and binders are readily available, the order of popularity being: (1) linseed oil, (2) mixtures of linseed oil with fish oils, (3) linseed oil with paraffin-base polymers, (4) paraffin-base polymers, (5) pitch bases, and (6) synthetic resins. While foundries making fittings prefer straight linseed oil or pitch binders, the bulk of cores are made from proprietary binders. Firms using sharp or drift sand prefer to use these single addition binders rather than add the various basic materials to the mill. A wide range of binders ensures that a suitable single addition binder is available for all types of cores and sands.

Current trends in core shops are towards more core blowing and more core sand mold assemblies. Continuous type core baking ovens, gas fired, are replacing drawer types in shops making small repetition cores.

In N.S.W. the drift from black sand for loam core making to oil sand cores is continuing, and Victorian foundries are realizing that their loam core making practice is no longer economical. Foundry sands vary in different states and are sold ungraded, although deposits from different areas serve as a means of obtaining some variations. In Sydney, N.S.W., natural loam is of one general type, some minor sieve variations being noticeable. Melbourne has a choice of three or four first-class uniform loams sufficiently different to warrant separate classification.

Sharp sand in Sydney is collected from sand dunes adjacent to the coast, has rounded grains with mesh sizes varying greatly from deposit to deposit, within a distance of 20 miles. No graded or washed sands are available in New South Wales, and foundries are forced to provide their own drying equipment. Melbourne sharp sands are sedimentary in nature, and are mined from large deposits extending along the old river basin miles inland. They are semi-angular, and some washed sands are available, although ungraded.

Look To U. S. For Foundry "Know How"

Much improvement has been due to better understanding of modern foundry technique, as pioneered and highly developed in the United States and made available to the Australian foundry trade through the publications of the American Foundrymen's Society and the generosity shown to our foundrymen who visit American plants. The value placed on these visits is evidenced by the fact that most prominent Australian foundry firms have either sent investigators to the States or contemplate doing so. Any such visitor, on returning to Australia, is almost plagued with inquiries by his Australian friends and is accepted as an authority whenever any contentious matter with reference to modern procedure is raised.

Special Train Required To Move Giant Cast Turbine Runner

Claimed by its maker to be the largest ever made, this giant one-piece cast steel turbine runner, one of three made by Erie Forge Co., Erie, Pa., for the Buggs Island Hydroelectric Power Project, presented a knotty problem in rail transportation. Weighing 165,000 lb and measuring 17 ft, 4 in. in diameter, this huge casting ran afoul of railway right-of-way clearance limitations and loading and shipment regulations. Erie Forge engineers, in cooperation with Pennsylvania Railroad officials, solved the problem by using two flat cars with a structural steel cradle between to suspend it for proper clearance. Special train, moving at a maximum speed of 15 mph in daylight only, made the shipment.

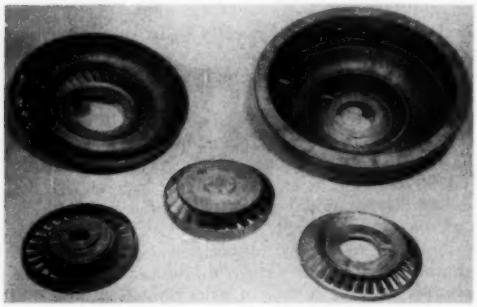
MODERN FOUNDRY METHODS...

PLASTER MOLDING FOR PRECISION CASTING PUT ON PRODUCTION BASIS

J. J. McClain, Chief Foundry Engineer
Light Alloys Foundry
Fabricast Division, General Motors Corp.
Bedford, Ind.

◀ *Checking a precision aluminum casting to make sure the vanes are within the 0.010 in. tolerance established.*

▼ *The five precision castings used in the Buick dynaflow transmission are intricate shrouded impellors and casings.*

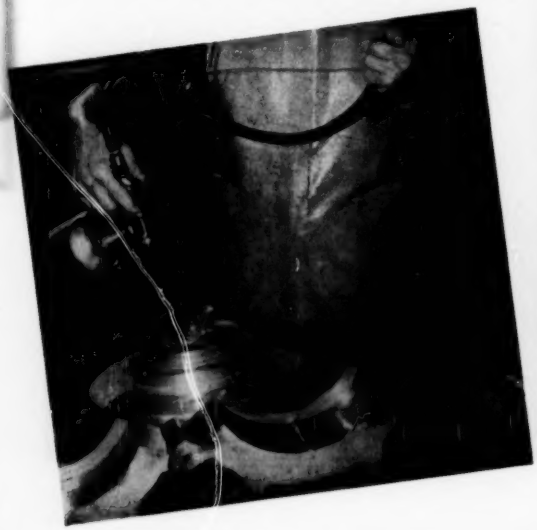


How the Fabricast Div. of General Motors Corp., Bedford, Ind., lives up to its slogan of "producing ferrous and non-ferrous castings to dimensional accuracy reducing fabricating time" is demonstrated in the production of the five precision aluminum alloy castings which form the converter end of the Buick automatic transmission. The five castings range in weight from 0.8 to 9 lb, in diameter from 6 to 12 in. Wall thicknesses vary from 0.0156 to 0.156 in. with a tolerance of only ± 0.005 in. Vane location must be held within ± 0.005 in. and cope and drag shift must be no more than 0.025 in. The castings normally operate at 3000 to 4000 rpm and may go up to 5000 rpm; oil pressure in the converter varies between 90 and 180 psi.

When called upon to produce these castings, the Fabricast Div. decided that an existing process, fully described in the literature, would lend itself to making the castings on a high production scale. Developing the

▼ *The correct amount of liquid parting sprayed onto the parts of the core box (left) assures clean separation of plaster core and box after initial setting of plaster.*

Immediately below the operator is assembling a cast aluminum core box which will be filled farther down the motorized conveyor line at the plaster pouring station.



technique along mass production lines, the division is producing 1500 sets of five castings daily on a 'round-the-clock operation. The procedure was described by the author at the Third Annual Metals Casting Conference, Purdue University, November 10-11, 1950, at the regional foundry meeting sponsored by the Central Indiana and Michigan chapters of A.F.S. and the university.

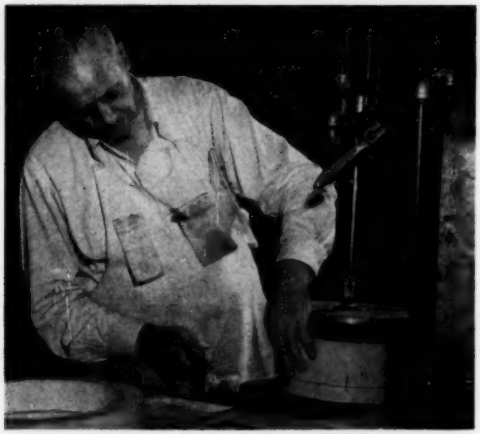
The process starts with the assembly of the metal molds in which the plaster cores and molds are cast. Molds are made of cast aluminum for convenience in handling. Sprayed with a proprietary liquid parting of high flash point, the metal molds are assembled on circular plates which rest on short cylinders with hand-grip cut-outs for handling to and from conveyor lines. Locating rings assure correct line-up. Molds for copes, drags, and vane cores are assembled on separate conveyor lines which pass a plaster pouring station where the plaster is cast.

➡ *Core box being removed after initial set of drag half of plaster mold. Air jet aids in separating mold and plaster core. Compressed air is also used to clean the boxes and to remove excess parting liquid if too much is applied during the mold assembly stage.*

⬆ *Overhead plaster mixing machine provides a slurry at the rate of up to 1200 pounds per hour and is readily accessible to all mold lines. Conveyor line in the foreground is for vane cores. Operator is filling cope and drag molds in line in background.*

The plaster mixture—containing calcium sulphate hemihydrate, water, sodium silicate, terra alba, talc, asbestos, and sand—is prepared as a slurry in an overhead mixing machine developed by General Motors Corp. The mixer has a capacity of 1200 lb per hr and distributes the slurry by gravity, supplemented by a pump when necessary, from its overhead position on rails which permit it to be moved to the pouring stations for the various conveyor lines. Filled with the slurry of the consistency of thick cream, the molds set up in about 10 minutes, and the metal forms can then be removed. Plaster drags are transferred to a conveyor belt which

Vane cores are added to the drag of the mold on this assembly line shortly after the plaster has its initial set.

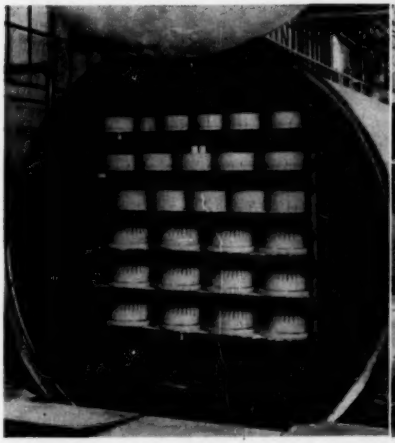


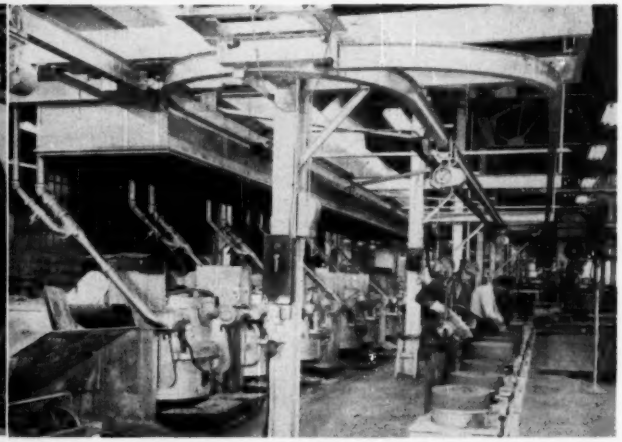
passes between a double row of assembly benches where the vane cores, which have been out of their molds about 15 minutes, are inserted. An overhead conveyor supplies the vane cores to the assembly benches. Final green strength develops in the plaster mold components as they stand in racks at air temperature for about four hours.

Copes and drags are fitted together and held in place by an air operated piston while corrugated metal fasteners are driven in at the parting line to anchor the mold. Next, the plaster molds are placed in an autoclave for

◀ *Before curing the relatively soft mold sections are joined by means of ordinary corrugated metal fasteners.*

⬇ *Below at the left the autoclave is ready to be closed on a load of assembled copes, drags, and vane cores. Immediately below is the pouring line for the precision castings. Some large molds require weights on the cope.*





◀ *Castings are separated from molds at the mechanical shakeout. Man at right is removing vane cores with pneumatic vibrator. Radial drills farther back remove sprues.*

a period of 5 to 9 hr, depending on their size, at a steam pressure of 9 to 17½ psi. This generates a temperature up to 250 F. In the autoclaving process, calcium sulphate crystals are converted from the dihydrate to the hemihydrate, setting up the conditions necessary to develop permeability in the molds. As the molds go into the autoclave they have a permeability of approximately zero. After recrystallization and baking the molds have a permeability of about 15.

Removed from the autoclave, the molds are allowed to stand for a period of 12 to 14 hr while the calcium sulphate reverts to the dihydrate, in the presence of excess water. This allows the grains to grow and upon subsequent drying at 470 F for 15 to 20 hr, the voids which contained the free water around the enlarged crystals are now escape avenues for mold gases and air. And the

molds and cores are ready for pouring in the melting department.

Some castings are poured entirely in plaster molds; some molds have ordinary core sand copes, while others have core sand pouring basins. Pouring occurs before a battery of gas-fired, tilting-type furnaces which melt 600 lb batches of a copper-silicon aluminum casting alloy containing about 0.5 per cent magnesium designated FD800. The magnesium improves the standard alloy's response to heat treatment. Pouring temperatures are controlled to within ± 10 F and pouring times, none of which exceed 15 seconds, are governed by the design of the pouring basins. No risers are used.

Poured weight of the largest casting which weighs 9 lb is 13 lb. The smaller castings with the thinnest sections have poured weights of 3.5 and 3.0 lb and finished weights of 0.875 and 0.9 lb, respectively.

Conveyor cars carrying the poured molds pass a forced-draft, ventilated mechanical shakeout where the plaster mixture (which cannot be used again) and the sand pass through the grizzly and are removed by means of an underground conveyor belt to a refuse storage bin. Vane cores are removed by a pneumatic vibrator.

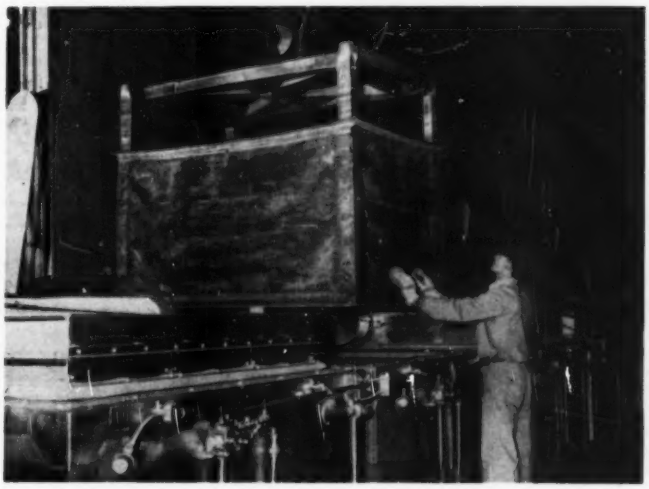
Sprues and popoff vents are removed by band saw and specially tooled radial drills. Last remaining plaster is removed by a stream of water and sand in a vapor blast cabinet. All castings are carefully inspected visually as they pass along a conveyor belt. All castings are checked by templates and periodic spot checks are made on a layout plate. The primary pump casting, the large outer casing, is tested at an air pressure of 60 psi using a water-soap mixture to detect leakage.

The precision aluminum alloy castings are given a solution-precipitation heat treatment in gas-fired, batch-type furnaces with controlled heating cycle. The solution treatment calls for holding at 940 F for five hours followed by a quench in boiling water. Aging is done at 475 F for five hours. Castings are carefully loaded and supported on special racks to avoid distortion and crushing during heat treatment.

Final visual inspection of castings. Castings with gates attached reach band saws in background by conveyor not shown. Shakeout is behind dust collector. Vapor blast is at left.

Primary pumps, the large outer castings, are tested for leakage at 60 psi air pressure with soapy water.

Loading one of the heat treating furnaces used for the solution and aging treatment given the castings.



STATISTICAL QUALITY CONTROL MANAGES FOUNDRY OPERATIONS

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APPLICATION OF STATISTICAL METHODS to control quality of castings started with World War II. The mathematical principles were known for quite some time before this but were not seriously considered in the industry. A.S.T.M. official publications[1] and other texts[2,3,4] adequately explain the mathematical principles of statistical quality control and numerous investigators[5,6,7,8] have described the methods used and their applications to individual processes. The purpose of this paper is to briefly describe how a modified statistical quality control system was used as a means of managing metallurgical operations in a Canadian foundry.

This particular plant operated three foundries which cast steel, cast iron and non-ferrous alloys. A wide variety of processes was involved, which made it extremely difficult for the chief metallurgist to maintain an adequate survey of all production factors due to the large number of data sheets, test results, inspection reports, etc., which had to be checked, and the multitude of problems which inevitably cropped up.

In order to simplify the data and provide a clear, concise picture of what was occurring and systemize the problems involved in the foundries, a modified statistical quality control system was conceived and put into operation. The functions of the system were classified into three general categories: (1) a study of processes by control charts; (2) departmental liaison and personnel management; (3) measurement of process results and research.

Processes Studied

The first function involved a study of metallurgical processes of the three foundries. To study these processes quality control charts were made on which were plotted all the test results of all the grades of alloys produced. The charts were divided into three sections: (1) standard grades of alloys; (2) special charts for production jobs; (3) charts showing deviations from normal expected values.

Sections (1) and (2) were sub-divided into groups which permitted a comparison of the different units producing the alloys. The charts in section (3) were used to detect variables in results of alloys made to engineering specifications such as ASTM standards. The results on the charts of all three sections were plotted in chronological order.

The charts gave a clear and concise picture of what was happening. In approximately 15 min the metallurgist could check all the charts and see the results of every process. All points falling outside the control limits were investigated to establish causes.

If the causes were assignable, allowances would be made for them if they could not be completely eliminated. Also, the fluctuations of the points about the average line were closely watched. If a prolonged series of consecutive points were all on one side of the average line a lack of control was indicated. Such series were investigated and either a significant trend in the process was discovered or the average would have to be checked.

Human Factors Controlled Statistically

The second function of this control system promoted an excellent liaison service between foundry departments. All foremen and workmen involved in any operation whose results were analyzed by this system were encouraged to study the charts and express their opinions. This procedure inspired confidence and maintained interest by presenting factual data in pictorial form. Any man could see the effect of the operations of his department on the final product.

One interesting aspect of this function was the use of pictorial data to manage personnel not having direct

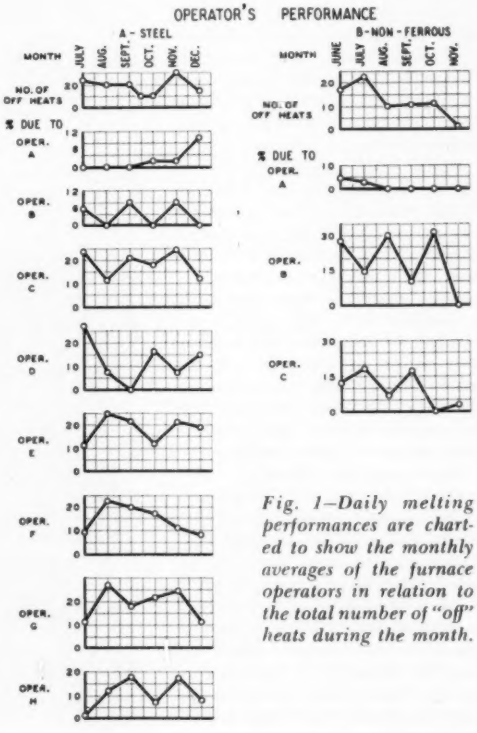

Fig. 1—Daily melting performances are charted to show the monthly averages of the furnace operators in relation to the total number of "off" heats during the month.

NOTE: This paper was presented, with other prize-winning entries in the Annual Technical Paper Contest of the A.F.S. Eastern Canada Chapter, at the Mar. 10, 1950 Chapter meeting.

supervision. In the steel and non-ferrous foundries, the individual furnace operators were responsible for the quality of their heats. Records were kept of the individual operators' results. If the assignable causes of the results falling outside of the control limits were due to melting practice, an "off" heat would be registered against the operator who made it.

Large boards in the form of baseball scoreboards were posted at the melting stations, and daily "averages" were posted. This system promoted a friendly rivalry between operators and its psychological effect maintained keen interest and incentive to do high quality work. This method of supervision showed that the quality of the metals produced increased as the system was used. Figure 1 shows the averages of the operators in relation to the total heats.

This type of quality record could be used as a rating of a man's work and be incorporated into a bonus system as well as the tonnage. The effect of these scoreboards was noticed in the final test results. The fluctuations about the average line were more regular and within a narrower band. This regularity and uniformity of results increased the quality of the products. Figure 2 shows a chart of the chemical analysis results of sulphur steel before and after the scoreboard was used.

Measured Results and Systemized Research

The third function of the quality control system was to systemize research and measure process results. Fraction defective or "P" charts were made from data obtained from investigations for assignable causes and inspection reports. Standard type average and range charts were kept to measure process results. Variables causing erratic results were graded in order of occurrence.

Figure 3 shows a fraction defective chart of scrap for steel and iron castings. Charts were made of time and power consumption and other miscellaneous factors in the metallurgical operations, including cost charts. Correlation was also used, to determine ideal conditions for highest quality results.

Data from heat histories, inspection reports, etc., were correlated to final results, and charts having continuous plots were maintained for all correlations having satisfactory coefficients. A first-hand picture of the factors warranting special investigation was thus obtained. The whole staff studied these charts and were constantly alert for new developments[9,10] to compensate for the more drastic discrepancies.

Summary

In summarizing, the author wishes to stress that the charts used in the first category were not "cure-alls" for the discrepancies of the processes, nor did they provide a remedy for variations in results. They did result in:

(1) Presenting in graphic form, a statistical measure of variations expected in the results, thus showing what the processes were capable of doing.

(2) Giving immediate warning when something erratic changed the conditions of the processes.

(3) Predicting the behavior of the properties of the products.

(4) Showing the level at which the processes were operating, and if they were operating with sufficient control to satisfy the results required.

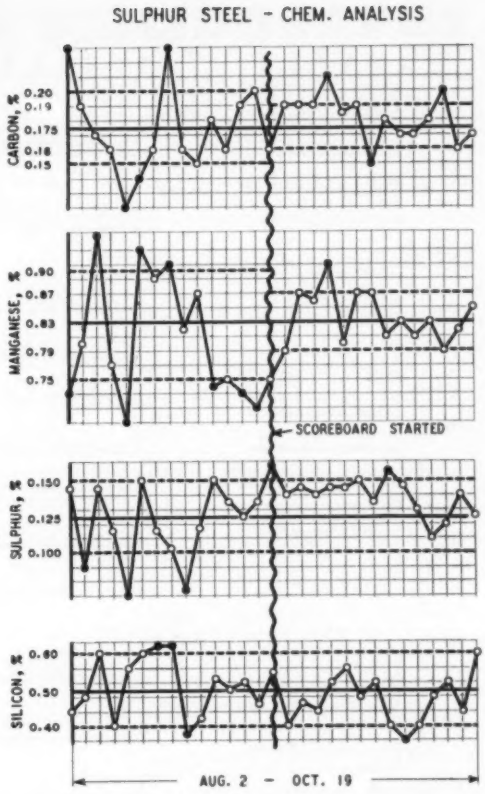

Fig. 2—Chemical analysis results for sulphur steel heats fluctuated less widely about the average line after the daily melting scoreboard was placed in use.

The success of the second function permitted a minimum of direct supervision of melting operations and showed possibilities of application to a higher level of management.

The functions of the third category permitted:

(1) An analysis of all causes affecting the processes' results.

(2) Determination of ideal conditions for highest quality results.

(3) Prevention of wasted time on investigating results that were "off" merely through chance causes, resulting in undertaking modifications and new developments where most needed.

It is stressed that the success of the system was largely dependent upon the speed with which the tests could be made, the data gathered, and plotted.

The cost of the system was relatively small. The installation of the control boards cost approximately $50.00, and the only maintenance cost was that of stationery. The main item was the time devoted to the operation of the system. In this particular plant

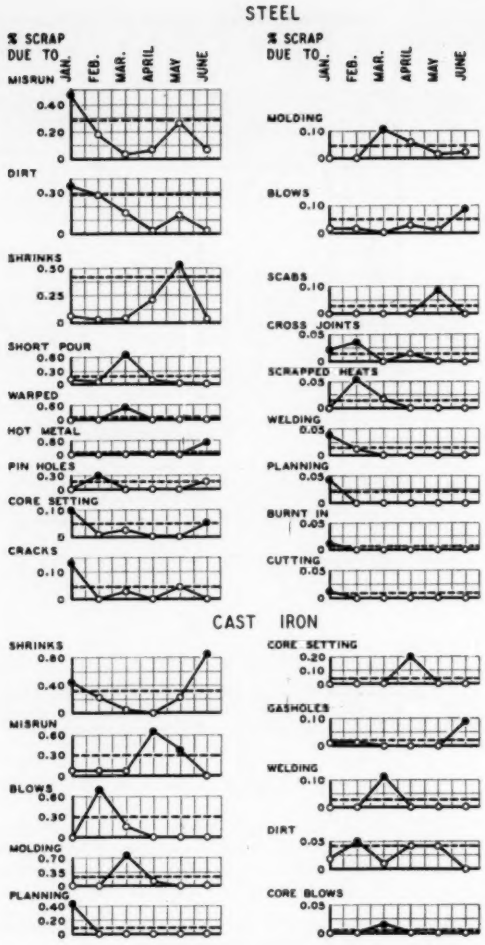

Fig. 3—Scrap analysis or fraction defective charts are plotted from data obtained from investigations for assignable scrap causes and inspection reports.

one man could usually operate the whole thing, but under abnormal conditions a second man was used as a "trouble-shooter." However, the staff required would generally depend on the size of the foundry, number and complexity of processes, and the importance attached to the system.

Acknowledgments

The author wishes to thank H. H. Fairfield, at present chief metallurgist of Wm. Kennedy & Sons Ltd., Owen Sound, Ontario, for supplying the data for the figures, and for whom the author set up the described control system; also, the management of the Dominion Engineering Works, Ltd., Lachine, Quebec, for permission to publish this paper.

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A.F.S. Transactions Mailed, Balance Selling At Post-Publication Price

MAILING of the 1950 edition of A.F.S. TRANSACTIONS to all who sent in a pre-publication order was completed December 9. Published as a limited edition, the cloth-bound volume contains all the technical papers and discussions presented at the 1950 A.F.S. Convention, exchange papers with foreign foundry organizations, reports on Society-sponsored research projects, committee reports and surveys, and the business transactions of A.F.S. for the 1949-50 fiscal year. The nearly 80 papers cover over 750 pages. No longer available at the lower pre-publication price, the 1950 edition of TRANSACTIONS can now be obtained from American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill., at a cost of $8.00 to A.F.S. members. Non-member price is $15.00.

Future Meetings and Exhibits

MALLEABLE FOUNDERS' SOCIETY, semi-annual meeting, Hotel Cleveland, Cleveland—Jan. 19, 1951.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 57th annual meeting, Philadelphia, Jan. 22-25, 1951.

WISCONSIN REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Wisconsin Chapter and University of Wisconsin, Schroeder Hotel, Milwaukee—Feb. 8-9, 1951.

A.I.M.E., annual meeting, Jefferson Hotel, St. Louis—Feb. 18-22, 1951.

BIRMINGHAM REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Birmingham District Chapter, Tutwiler Hotel, Birmingham, Ala.—Feb. 22-23, 1951.

AMERICAN SOCIETY FOR TESTING MATERIALS, committee week, Netherland Plaza Hotel, Cincinnati, Mar. 5-9, 1951.

OHIO REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Northeastern Ohio, Cincinnati District, Toledo, Canton District, Central Ohio, and Ohio State University Student Chapters, at Case Institute of Technology, Cleveland—Mar. 8-9, 1951.

WESTERN METAL CONGRESS AND EXPOSITION, Civic Auditorium, Oakland, Calif., Mar. 19-23, 1951.

55th Annual Foundry Congress, American Foundrymen's Society, Buffalo, N. Y.—Apr. 23-26, 1951.

AMERICAN SOCIETY FOR QUALITY CONTROL, annual convention, Hotel Cleveland, Cleveland, May 23-24, 1951.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Chalfonte-Haddon Hotel, Atlantic City, N. J., June 18-22, 1951.

MALLEABLE FOUNDERS' SOCIETY, annual meeting, the Homestead, Hot Springs, Va., June 21-22, 1951.

NODULAR IRON—A BIBLIOGRAPHY

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RECENT LITERATURE on nodular cast iron is listed in the following as added material to the bibliography published in the July, 1950 issue of AMERICAN FOUNDRYMAN. Originally presented at the A.F.S. 1949 New York State Regional Foundry Conference, the bibliography has been greatly expanded.

The prefix letter before each reference denotes the first letter of the senior author's name, and the group numbers have been spaced to allow for future insertions. Articles which were published without authors' names are listed in the bibliography under "A" in the number group less than one hundred.

The index immediately following includes the more general classifications of articles listed in both the July, 1950 and this issue of AMERICAN FOUNDRYMAN.

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Historical: G-100, G-101, M-301, M-600, P-1, P-103, S-1, V-100.
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(a) Metallography: A-100, A-190, D-19, E-1, E-4, G-1, H-50, M-304, N-5, P-30, Z-100.
(b) Electron Microscopy: T-200.
(c) Nodulization: (1) Theory and Practice: B-200, D-11, D-17, D-19, E-13, K-102, M-304, M-500-7, N-5, P-20.
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(3) Patents: A-22, under "P" patent section, S-2.
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(2) Large castings, A-21, D-16, G-20, H-70.

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FOUNDRY SAND—GETTING DOWN TO FUNDAMENTALS

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A number of thoughts that have been derived from work on sand control fundamentals at the University of Kentucky are presented in this paper which indicate that, whether he likes it or not, the average foundryman will have to acquire a working knowledge of what is really fundamental to sand control.

MASS ENTHUSIASM can make an entire industry select the wrong road in seeking to achieve progress. After traveling for some time, and finding that the road leads not to progress but to confusion, the industry has little choice but to retrace its steps and start over again. It may be surprising to many foundrymen to find that the foundry industry chose the wrong road in the development of foundry sand control, that we are just about where we started from some years ago, and that it remains for the industry to travel a new road if it desires to place foundry sand control on a firm scientific basis.

To better develop what is to follow, some space must be devoted to differentiating between empirical and fundamental knowledge.

An empirical investigation of an industrial process is most concerned with the influence of material and mechanical factors on the results obtained. Empirical experiments are more or less a matter of determining by trial and error what factors are most influential, and how the factors can be varied to secure a related variation in the end results of the process. Essentially, empirical knowledge defines an industrial process in terms of the materials and equipment involved.

Control by Experience

Empirical knowledge is primarily concerned with "know what" and "know how." For example, experience may reveal that a certain sand mixture is quite sensitive to variations in moisture content. By varying the moisture content, one can secure either good castings or scabbed castings. This empirical knowledge, based on experience, makes it evident that moisture is an influential factor, and that moisture must be controlled within a certain range to produce good castings.

Thus, empirical knowledge can define "know what" (the moisture) and "know how" (moisture control) without defining "know why" (why moisture causes scabs). From an empirical viewpoint, it is not essential to *know why* a scab results from excess moisture; it is only necessary to *know what* seems to cause a scab, and to *know how* to keep the scab from forming. This example should make it evident that empirical control can be blind control; i.e., one can exercise control without really knowing why the control is effective in preventing formation of a scab.

The foregoing example can also be used to define the shortcomings of reasoning based on empirical knowledge. Although this particular sand mixture may require the moisture content to be held between 3.0 and 3.5 per cent, one cannot claim that all sand mixtures must be worked within this same moisture range.

While one can state that excess moisture evidently causes scabs, one cannot conversely state that all scabs result from excess moisture. It is well known that overramming, or excessive slicking of a mold surface, can also contribute to the appearance of scabs. To correctly state the observed relationship between moisture and the creation of scabs, one must qualify the observation in the following manner: It has been observed that with regard to a particular sand mixture, under the particular conditions covering its application to a particular class of castings, it evidences a tendency to scabbing unless held within a particular range in moisture content, with all other material and mechanical factors being held as constant as possible.

Applications Qualified

The insertion of the above qualifications in defining the relationship between moisture and scabs should make it self-evident that empirical knowledge is very limited knowledge, that is, the information cannot be applied to production in another foundry unless it is applied with these qualifications.

Further, the use of empirical knowledge to advance theoretical reasoning is both complicated and dangerous. If any of the essential qualifications are inadvertently omitted, the reasoning may lead to a general acceptance of concepts that are misleading and confusing when applied in practice. As will be made evident, it was an unfortunate failure to note certain important qualifications that placed the foundry industry on the wrong road in the development of foundry sand control.

A fundamental investigation of a process is also concerned with the results obtained under the influence of a number of factors and a variety of conditions. However, from the fundamental viewpoint, the results are obtained because the process is functioning in accordance with the principles of the fundamental sciences—chemistry, physics, and mathematics. These sciences, and their principles, are represented in a process by the fundamental factors of composition, temperature, and time.

Must Know What, How, Why

Essentially, the objective of a fundamental investigation is to determine the reactions, effects, and countereffects that take place between composition temperature, and time, and thus define why the observed results are obtained. In other words, from the fundamental viewpoint it is not only necessary to know what is influential, and know how it is influential, but also to know why it is influential. Fundamentally speaking, a blind control of the basic relationships of a process is bound to lead to trouble.

NOTE: This paper was presented at the Ohio Regional Foundry Conference, sponsored by the A.F.S. Ohio Chapters, at Cincinnati, March 10-11, 1950.

When we speak of getting down to fundamentals we are referring to the steps required to reduce the material and mechanical factors of a process to their simplest forms with respect to composition, temperature, and time. The material and mechanical factors in a process are important. However, their importance is derived from the fact that it is through these factors that we determine the nature of the fundamental factors, and control the influence of the fundamental factors, on the functioning of a process.

Study Defects to Prescribe Cure

In controlling the processing of foundry sands, our control of the material and mechanical factors of the process is only a means to an end, not the end itself. What we are trying to do is predetermine, insofar as possible, what reactions, effects, and countereffects will result when molten metal meets a rammed sand face. Through direct control of the material and mechanical factors, we achieve an indirect control over the fundamental factors.

Referring to the previously discussed hypothetical moisture-sensitive sand mixture, it can be stated that, from a fundamental viewpoint, it is not so important that that particular mixture could produce a scab. Of greater importance is the fact that most molding sand mixtures are prone to scab unless properly handled. From a fundamental viewpoint, the disease must be given precedence over the preventive medicine. Therefore, it is essential that the disease (scabs) be studied and defined in detail before one attempts to prescribe the proper preventive medicine (sand control measures).

At the risk of oversimplification, it can be stated that the difference between empirical and fundamental knowledge can be defined as follows: Fundamental knowledge seeks to define a process disease before defining the essential preventive medicine. Empirical knowledge seeks to discover the preventive medicine without having to define the disease. Most of our present day sand control practices have been developed as preventive medicine for the diseases (defects) that we really know very little about.

Instruments Measure Properties

With the advent of green sand molding, molding machines, and increased production, some form of control was needed to maintain uniformity in sucessive batches of sand and consistency in day to day operations. Since time immemorial, molders have evaluated the molding characteristics of a sand mixture by noting the strength and feel of a specimen when compressed in the hand. Perhaps for this reason the controls that evolved were based on instruments designed to measure the room-temperature properties of a bonded sand mixture prior to its use in molding.

It cannot be denied that science is dependent upon measurements. A step towards scientific control was to devise means of measuring variable physical properties; thus establishing standards for the maintenance of uniformity in successive batches of sand. When the instruments were generally adapted to foundry sand control, noticeable improvements were evident in most foundries.

The increased uniformity in the processing of sand mixtures brought about a related increase in the consistency of day to day operations and casting results. In other words, the improvements that normally accompany the standardization of any industrial process were realized through the use of these instruments and their measurements of the physical properties of bonded sand mixtures.

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Unfortunately, these same improvements inadvertently contributed to the general acceptance of the initial erroneous conception in foundry sand control.

Rammed sand specimen is ready for immersion in molten steel at 2950F in dip-test for foundry sand control.

One now can comprehend how enthusiasm led many foundrymen to deduce that, since the improvements had been obtained through physical property measurements, such measurements were solely responsible for the improvements. As with most empirical deductions, there was enough apparent truth in such reasoning to cause most foundrymen to overlook the all-important qualifying conditions pertinent to standardization and uniformity.

Thus, instead of the improvements being attributed to standardization, they were attributed to the physical properties being measured. Instead of the measurements being accepted as only relative to the maintenance of uniformity, they were accepted as being relative to the evaluation of quality. Through this sequence in empirical reasoning, a concept was born that has persisted to this day. Many foundrymen still believe that the probable casting behavior of an unknown and untried sand mixture can be predicted from its room temperature physical property measurements.

Of more immediate importance was the effect of this mistaken concept upon technical thinking. The literature was flooded with discussions of the improvements to be obtained through technical control of foundry sands. Papers were contributed on the relative importance of such properties as green strength, per-

meability, etc., to proper control. Other papers attempted to define the most desirable ranges in physical property values for the production of various types of castings.

Through these contributions, the concept won such a general acceptance that it became the basis for the advancement of still other concepts, thus piling error upon error, confusion upon confusion. Through the influence of this initial erroneous concept, the entire foundry industry was placed on the empirical road to the development of foundry sand control.

Eventually, some indications of the inherent flaws in the reasoning became evident. It was observed that some sand mixtures (with the best of physical properties) consistently failed to produce good castings. Also, it was noted that two foundries might be making the same type of castings with sand mixtures greatly differing from one another with regard to their respective physical properties. However, these indications did not bring about a correction of the situation. Instead, they inspired further empirical advances.

It was deduced that the seemingly unexplainable behavior of some sands might be more closely related to their physical properties at elevated temperatures than to their physical properties at room temperature levels. Additional instruments were soon forthcoming to measure hot strength, collapsibility, expansion, contraction, and the sintering points of different sands and bonds.

Again, the literature was flooded with more discussions aimed at correlating these new-found properties with sand behavior. Again, after the elapse of some time, it became evident that some sand phenomena were as enigmatic as ever. For example, despite all of the equipment, experimental data, and profound theories, controversy continued with regard to the factors responsible for casting surface defects.

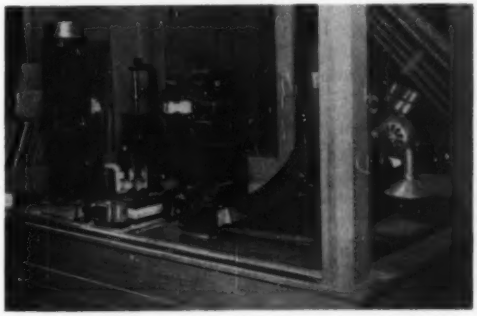
Increasing Recognition of Fundamentals

In the literature one finds arguments attributing scabs to high moisture and steam pressure and other arguments attributing scabs to expansion and contraction. One finds penetration being related to the formation of ferrous oxide with another faction contending penetration is a purely mechanical result related to improper void dimensions between sand grains. Not only did the controversy continue with regard to the mechanisms of defect formation, but most foundries discovered that, despite the very best in preventive medicine, epidemics of casting defects continued to occur with surprising frequency.

The fact that the accumulated knowledge could not satisfactorily explain the mechanisms of defect formation, let alone control them, made it quite apparent that something was wrong with the technical picture. Although a great deal of useful information had been acquired on the characteristics of molding sands at elevated temperatures, it seemed questionable whether the information had clarified the situation or had but further complicated an already complex matter. In brief, it began to dawn on various investigators that they had been dealing with empirical knowledge, not fundamental knowledge, and it was time to get back to fundamentals in sand control.

The resulting movement back to the road that leads to fundamental knowledge has taken place during the past few years. Its beginning and progress can be traced in the literature by noting the increasing number of discussions concerned with the influence of grain shape, size, and distribution. Taken together, these discussions developed that the inherent physical nature of a base sand definitely influences its casting behavior.

It was concluded that the casting behavior of a rammed sand face in the presence of molten metal is related to its physical structure, more particularly to the physical relationships established within its structure, especially its rammed compactness. This conclusion was summarized by stating that the thermal



Laboratory equipment for room temperature testing of sand mixes is grouped in a glass-enclosed cabinet.

stability of a sand mixture is related to its rammed density. Thus, two new terms were added to our foundry sand terminology.

Physical properties are the measurable evidence of physical relationships. Physical relationships, in turn, only exist because of the manner in which fundamental factors are combined. From a practical viewpoint, the foregoing studies served to focus attention on a need for knowledge that would permit a sand technician to predict the response of physical relationships to thermal impact and shock. From a more fundamental viewpoint, they evidenced a movement from a consideration of physical properties to a consideration of physical relationships.

Develop Sand Dip Test

The most recent, and most effective, contribution in getting down to fundamentals has been Caine's work on dip-testing. The dip-test involves the immersion of rammed sand specimens into molten metal. Variations are introduced into the testing procedure by over-ramming or under-ramming the specimens, and by varying the manner in which specimens are immersed so as to simulate radiation only, alternate immersion, etc. Under the imposed testing conditions, the time required to produce surface failure is measured in seconds. Caine has shown that sand mixtures that do not fail within a certain number of seconds are not likely to fail in actual production.

From a practical viewpoint, the Caine dip-test is the answer to securing information that will permit a sand technician to predict the probable response of a sand

mixture to thermal impact and shock. Its fundamental possibilities are of even greater importance.

The fundamental significance of the dip-test lies in its ability to provide a means of investigating the reactions, effects, and countereffects that are injected into the processing of foundry sands when the fundamental factors of composition, temperature, and time are suddenly combined. In other words, with the development of the dip test the industry got back on the road to fundamental knowledge and, simultaneously, investigators were handed a tool for getting down to fundamentals.

It is not intended to imply that all of the information acquired in our empirical travels is valueless. However, we are going to have to do a job somewhat similar to tearing down and rebuilding a house. Our existing technical structure has been largely built from empirical knowledge. We are going to have to tear it apart, critically examine each piece, and put it together again upon a fundamental basis.

Controls Based on Experience

In actuality, the foregoing disclosures will do little towards disturbing the present tenor of sand control in the individual foundry. Most thinking sand technicians have been aware for some time of the fallacies in many of the concepts that have been advanced in the literature. As a result, most foundries have simply developed their sand control practices in accordance with their individual requirements and operating conditions. The empirical knowledge that has been acquired by the individual foundry from its own experience can be accepted by that foundry as being trustworthy. The essential qualifications are inherent in its origin and in its application within the same foundry.

The criticism of the original interpretation of room temperature physical property measurements should not be construed as meaning that such measurements are not useful in sand control. They are of great value if applied to the maintenance of uniformity in standardized production mixtures. They are almost worthless in predicting the probable behavior of an unknown and untried mixture.

If it becomes necessary to determine the casting behavior of a new mixture, probably the best way is to simply try it on a casting. However, in some ways the Caine dip test may be superior to an actual casting test. Production mixes are usually applied to a range in casting types. If a mixture is tested on a casting at one end of a production range, it may perform satisfactorily, only to fail when applied to a casting at the other end of the range. Under the variety of testing conditions that can be simulated in the dip test, a critical range in application may be detected before it contributes to the production of a number of defective castings.

With respect to the present status of foundry sand control, the individual foundry must depend upon its past experience to stabilize its operating conditions, the dip test to determine the critical application range for old and new mixtures, and the use of room temperature property measurements to maintain uniformity in the mulling and molding of sand mixtures. The development of scientific principles for foundry sand control must await the development and dissemination of more fundamental knowledge.

The foregoing discussion should make it apparent that much confusion in thinking has arisen from the empirical treatment of sand problems. Too many investigators have been prone to analyze the processing of foundry sands by considering the successive stages from beginning to end.

With such an approach, one cannot avoid being overwhelmed by the multitude of material and mechanical factors introduced in compounding, mulling, molding, finishing, and drying. Little thought can be given to factors introduced with the pouring of metal into a sand mold. Yet, the fundamental factors do not become operative until metal is poured into a mold. It requires the presence of molten metal to activate the fundamental factors of composition, temperature, and time, and it is only through the control of these fundamental factors that we can establish scientific control of foundry sand behavior.

It takes time to disseminate new ideas throughout the industry, and it takes time to eliminate old ideas that are no longer acceptable. It is hoped that this paper will expedite the eventual transition of the industry from an empirical to a fundamental viewpoint with regard to foundry sand control.

Acknowledgment

The writer wishes to thank Prof. C. S. Crouse, Head, Department of Mining and Metallurgical Engineering, University of Kentucky, for permission to publish this paper.

Stainless Steel Turbine Runner

Weighing 16,000 lb and measuring 8 ft in diameter, this stainless steel hydraulic turbine runner forms the framework for this unusual foundry shot taken at Bethlehem Steel Co., Bethlehem, Pa. Silhouetted workman is using a grinding wheel to finish runner's 16 blades, which will be water-rotated. Turbine shaft will be fitted into hole at workman's back.

Single Official Convention Issue Scheduled for Publication in 1951

DEPARTING from practice of recent years, AMERICAN FOUNDRYMAN will publish only a single official A.F.S. Convention issue instead of the customary pre-Convention and post-Convention issues. In 1951 the official Convention issue for the Society's Annual Foundry Congress will be published in April and will include the entire program for the Convention with all events, titles of papers, authors and co-chairmen.

The popular April issue feature of two years ago, Products Parade—"An Exhibit on Paper"—will again picture and describe the outstanding products and services available to the Foundry industry. This non-exhibit year section of "The Foundrymen's *Own* Magazine" will replace the Buyers' Guide which has been part of the April and May issues of previous years.

Among other features of the April issue of the Society's official publication will be pictures and biographical sketches of the recipients of the A.F.S. Gold Medals and Honorary Life Memberships, the Hoyt Annual Lecturer and the Annual Banquet speaker, and authors of exchange papers. Local committee members and Ladies' Entertainment Committee members will be pictured, as will current national officers and directors of A.F.S. The technical papers of the April issue will include some of the papers to be presented at the 1951 Convention in Buffalo, N. Y.

Complete story of this year's A.F.S. Convention and pictures of Convention activities and attendants will appear in the May issue of AMERICAN FOUNDRYMAN. Also reported will be the new officers and directors elected at the Annual Business Meeting, and the winners of the 28th Annual A.F.S. Apprentice Contest.

Late Enrollees: Still Have Chicago Chapter Training Program Openings

FOUNDRYMEN from the Chicago area are learning how to do better work at the Chicago Chapter's seven-session educational course which started January 8 with a meeting on quality control through the laboratory. Still open to late enrollees, the remaining six demonstration-discussion meetings will be held 7:30 to 9:30 p.m. in the auditorium of the Peoples Gas Light & Coke Co., 122 S. Michigan Ave., Chicago. Dates and subjects announced by Course Chairman Harold G. Haines, Howard Foundry Co., are:

January 22—*"Modern Molding Methods"*
February 12—*"Modern Coremaking Methods"*
February 26—*"Improved Foundry Safety"*
March 12—*"New Methods of Gating"*—features the latest color-sound A.F.S. research film on fluid flow.
March 26—*"Defective Castings and What to do About Them"*
April 9—*"Bonus Meeting"*—surprise meeting to be announced

Posters and enrollment blanks have been sent to all Chicago-area foundries. To register, send $1.00 and enrollment blank to Edwin H. Pritchard, Western Materials Co., 59 S. LaSalle St., Chicago 3, Ill. Registration can also be made at any session of the educational course.

Chicago Chapter members who planned the program, in addition to Messrs. Haynes and Pritchard, are: A. C. Erlandson, Pettibone Mulliken Corp.; Albert P. Di Girolamo, Chicago Steel Foundry Co.; John F. Dix, Superior Aluminum Foundry and Austin High School; R. W. Schroeder, University of Illinois, Navy Pier Branch; and Cecil F. Semrau, Illinois Malleable Iron Co., all of Chicago.

Sculptor-Foundryman Dies

F. C. Hibbard

FREDERICK C. HIBBARD, 69, famed Chicago sculptor, who designed the five A.F.S. gold medals, died of bronchial pneumonia December 12. No stranger to the foundry techniques, he did most of his work in cast bronze, frequently doing much of the finishing of the molds used in casting his statuary. While his work has been cast elsewhere in recent years, most of it was done in the Chicago Art Bronze Works operated for many years as a hobby by a former president of the Union Stock Yard & Transit Co., Chicago, and burned out in the Stock Yard fire of 1934.

Mr. Hibbard's work came to the attention of the foundry industry through his monumental portrait of Mark Twain. This stood in the center of the arena in the International Amphitheatre during the 1913 Foundry and Machine Exhibition in Chicago, following arrangements by C. E. Hoyt, retired executive vice-president of A.F.S. Nearly 20 years later Mr. Hibbard was commissioned to design the Society's gold medals. These he did with great realism, even weighting the two-man ladle, which forms part of the detail on one side of each medal, with lead so his model—a foundryman—would have to pose exactly as if he were pouring molten metal. While sculpturing the pouring end of the shank, the pivot end was merely propped in place. The same foundryman subsequently posed holding the pivot end while the other end rested on a box.

Mr. Hibbard was born near Canton, Mo., and early displayed talent for art by modeling in local clays while a young farm boy. After studying at the Art Institute of Chicago he worked a year with the late Lorado Taft before opening his own studio. From then until 1948, when he completed his last work, he produced the many pieces of art and statuary which won him national acclaim. Among these—located in 27 states—are his statues of Mark Twain, and of Tom Sawyer and Huck Finn in Hannibal, Mo.; the United Daughters of the Confederacy memorial at Shiloh National Park; and a five ton granite group of Mary Todd and Abraham Lincoln in Racine, Wis.

Among his well-known Chicago statues are two bronze fountain groups in Grant Park, a memorial figure of a World War I doughboy at Hines Veterans Hospital, and a memorial fountain near the Chicago Historical Society in Lincoln Park. His last work was a memorial to Illinois men who fought in the Spanish-American war.

BASIC LINED CUPOLA PERMITS USE OF LOWER GRADE SCRAP AND COKE

Sam F. Carter
Ass't Melting Supt.
American Cast Iron Pipe Co.
Birmingham, Ala.

OF FOUR POSSIBILITIES for the use of the basic lined cupola the most promising application seems to be in the nodular iron field. The basic lining and the use of calcium carbide as a flux make for the low sulphur and the high carbon desired. Alloy costs may be reduced and control improved by melting a low sulphur iron, and the cost of the low phosphorus base metal charge may be reduced with more steel and scrap.

A second application is the use of more high sulphur scrap and lower quality coke to make gray iron of normal or low sulphur content without the need for ladle desulphurization. Third use is for reducing the phosphorus content directly by oxidation or indirectly by increasing the proportion of steel scrap. Some control over phosphorus and sulphur should relieve foundries from complete dependence on raw material quality which seems to be steadily declining.

A fourth application for the basic lined cupola is in duplex steelmaking.

Summarize Four Years' Work

Research begun some 4 years ago in the author's plant included experimental heats in a small cupola as well as production tests on small cupolas operated regularly. A summary of this work in a pair of 23-in. cupolas—one acid, the other lined with dead burned magnesite brick—and 36-in. production cupolas is given here. Details appear in A.F.S. TRANSACTIONS.*

The work done at American Cast Iron Pipe Co. indicates that on both production heats and short experimental heats, the life of the magnesite lining has been considerably better than clay brick, partially offsetting the high material cost of basic refractories. Operation was effected with reasonably consistent chemical control and little refractory trouble. The basic lining permitted extremes in slag chemistry which produced valuable changes in metal chemistry and a flexibility that has never been associated with cupola melting.

Removal of 20 to 30 points of phosphorus was accomplished with several combinations of basic fluxes and oxidizing agents. An additional 10 to 15 points has been removed in the ladle by similar reagents. The principal disadvantages are the low temperatures obtained and the ladle additions necessary to restore the silicon content.

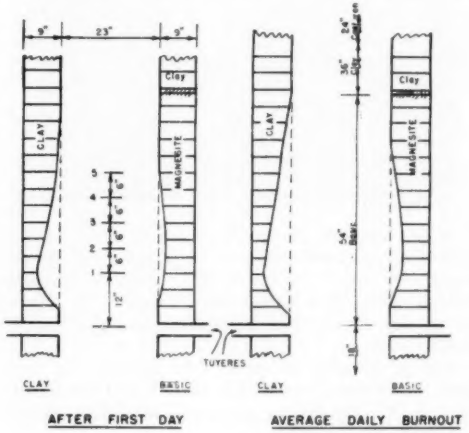
Desulphurization is accomplished in a more natural manner in a basic cupola. Sulphur content is lowered some by the naturally increased basicity of the slag from a basic lined cupola. From 0.020 to 0.040 per cent lower sulphur pickup was obtained from the same charge at usual sulphur levels, and as much as 0.100 per cent lower at high sulphur levels. Further decreases in sulphur were found to require lower iron oxide in the slag as well as higher basicity than normally encountered in the cupola. Greatest desulphurization efficiency resulted from the use of strong reducing agents like commercial calcium carbide used within the cupola.

In addition to very efficient desulphurization, the carbide produced an increased carbon pickup, an increased temperature, and a decreased loss of oxidizable elements. The increase in carbon pickup has been sufficient to produce 3.20 to 3.50 per cent carbon iron from all steel charges. Such carbon absorption provides indirectly a second means of lowering phosphorus through the use of higher proportions of steel, and with some economic advantage under certain raw material situations.

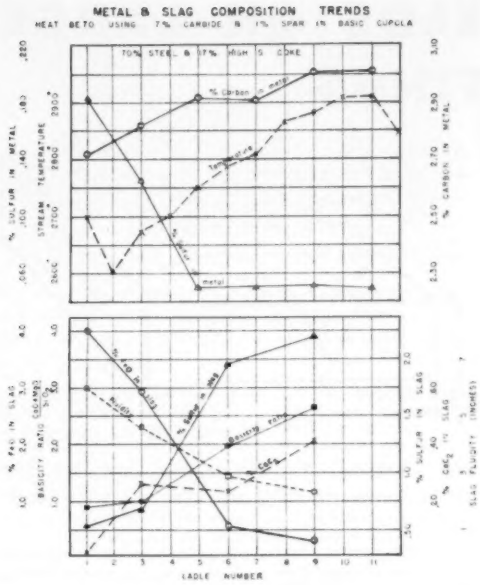
Slag analyses from both acid and basic heats with essentially the same charge and flux, with no attempt to modify slag composition, show little significant difference in alumina, iron oxide, and manganese oxide. Acid slags ran 15 per cent higher in silica, and basic slags 6-12 per cent higher in magnesium oxide due to consumption of the respective refractories.

From a theoretical standpoint, removal of phosphorus requires oxidizing conditions to convert the phosphorus to its oxide and a slag with excess basicity to retain the phosphorus oxide in the slag as a basic phosphate. Silicon is oxidized at essentially the same temperature, interferes with the reaction, and theoretically must be removed first. In the author's work,

Average daily burn back in the 23-in. acid cupola was 7in., for the basic cupola only 3½ in. Basic cupola required only one-third as much material for patching.



*Sam F. Carter, "Basic Lined Cupola for Iron Melting," A.F.S. TRANSACTIONS, vol. 58, pp. 376-392 (1950). The paper was presented at the 1950 A.F.S. Convention and at the 1950 Michigan Regional Foundry Conference.



Successive taps from basic cupola operating on 70 per cent steel charge with calcium carbide slag are graphed to show changes in metal and slag composition.

phosphorus was reduced from 0.74 to 0.55 per cent using a low bed, a low coke ratio, and 10 per cent limestone and one per cent fluorspar as flux. More coke was used on other heats with 3 per cent iron ore as an oxidizer to get essentially the same elimination of phosphorus. Silicon is reduced by the dephosphorizing treatment and needs to be restored with ladle additions if the metal is to be gray as cast.

Desulphurization is accomplished more efficiently under reducing conditions. Conventional fluxes in the basic cupola prevent normal sulphur increases and 0.070-0.090 per cent can be obtained from a charge that would normally give 0.090-0.120 per cent sulphur. Larger than normal quantities of fluxes brought the sulphur down to 0.040-0.070 per cent. Calcium silicide and silicon carbide produced only a slight improvement in desulphurizing but calcium carbide was markedly effective. In addition it resulted in improved carbon pickup and increased temperature.

Using calcium carbide, maximum temperature was unaffected but average temperature was increased. An average temperature of 2850 F was obtained with a 17 to one coke ratio. Melting rate was increased 40 per cent. However, carbon was decreased by each coke reduction and sulphur was increased, indicating that carbide can be substituted for coke but at a sacrifice of reducing influence and desulphurizing effectiveness. These effects were duplicated with coke of average foundry quality, decreasing the coke to as low as 4 per cent or 25 to one.

Most effective use of the calcium carbide is made when 10 charges of carbide are placed in the bed so that the heat starts with a strong basic, reducing slag.

TABLE 1 CHEMICAL COMPARISON OF BASIC AND ACID HEATS

	Steel, %	Coke, %	Si Loss, %	Mn Loss, %	C pick-up, %	Final S, %	Final P, %	Ave. Temp., F
Basic*	59.3	15.8	31.4	16.7	1.46	0.087	0.087	2765
Acid*	56.0	18.0	22.6	27.3	1.37	0.117	0.093	2773
							Lining Burn Back, in.	
Basic**	65.0	20.0	27.0	14.0	1.87	0.051	2.4	2760
Acid**	35.0	18.0	14.0	21.0	0.74	0.085	6.9	2750

* 23-in. production cupola, 9-hr shift, final iron analysis: Si, 3.00%; C, 2.60; Mn, 0.80.

** 36-in. production cupola, intermittent tap, 6-8-hr shift; final analysis: Si, 2.00% C, 3.40; Mn, 0.60. In 36-in cupola flux was 4% limestone for acid heats, 4% limestone plus 1/2% fluorspar for basic heats.

TABLE 2 BASIC HEATS WITH ALL STEEL CHARGES

(All charges 100% steel scrap melted with 16% coke "A", theoretical composition, C, 0.20%, S, 0.050, P, 0.030, FeSi and FeMn added)

Heat	Flux	Ave Final Composition, % Si	Mn	C	S	Temperature, F Ave.	Max.
380	10% limestone, 10% fluorspar	2.34	0.67	2.48	0.081	2760	2805
503	5% limestone, 1% fluorspar, Si as CaSi	2.08	0.99	2.48	0.119		
390	5% silicon carbide, 5% limestone, 1% fluorspar	2.60	0.77	2.41	0.116	2770	2800
370	5% calcium carbide, 5% limestone, 2% fluorspar	1.27	0.85	3.17	0.048	2810	2920
518	6% calcium carbide (bed), 5% limestone, 3% fluorspar	2.67	0.88	3.52	0.025	2850	2935
520	3% calcium carbide (bed), 5% limestone, 3% fluorspar	2.41	0.89	3.50	0.026	2885	2920
521	1 1/2% calcium carbide (bed), 5% limestone, 3% fluorspar	2.40	0.85	3.19	0.047	2845	2880

TABLE 3 HIGH CARBON BASIC HEATS (ALL PIG IRON) FOR NODULAR IRON

(Using 14% coke "A", theoretical charge composition 0.03% S and 4.20% C)

Heat	Flux	Final Average, % Si	Mn	C	Sulphur, % Ave.	Min.	Temp. Level, F	Slag Fluidity
81	3% limestone	1.57	0.15	3.90	0.073	0.064	2700	Fluid
160	7% limestone, 1% fluorspar	2.34	0.15	3.80	0.022	0.015	2700	Fluid
511	5% calcium carbide, 5% limestone, 2% fluorspar	2.77	0.15	3.97	0.014	0.009	2730	5 in.
512	Same as Heat 511	2.37	0.11	4.09	0.010	0.009	2700	Shut down
517	6% calcium carbide (bed), 5% limestone, 3% fluorspar	1.98	0.14	4.11	0.009	0.005	2780	5 1/2 in.

Experimental heats for C. K. Donoho's research on nodular iron show that the basic cupola with carbide flux is economically in line from the sulphur standpoint alone. Calculations show that an alloy saving through lower sulphur more than offsets the cost of the carbide and the extra cost of the basic lining.

Belgian Volume Is Library Addition

NEWEST ACQUISITION of the American Foundrymen's Society Library is a 243-page paperbound volume, *"L'Eau Potable a Travers les Ages"* (Drinking Water Through the Ages), written by Bernard Buffet, chief engineer, and Rene Evrard, directing secretary, Compagnie Generale des Conduites d'Eau, Liege, Belgium, and presented to the A.F.S. Library by Robert Doat, company engineer, who represented the Belgian Foundry Association at the recent 54th A.F.S. Foundry Congress and Show in Cleveland.

Illustrated with drawings and photographs, many of them collector's items, this volume details the history of mankind's efforts to obtain, transport and store drinking water. Beginning with the ancient wells and primitive water-carrying methods of the Orient, this book describes the aqueducts of the Greek and Roman empires and the Middle Ages, up to present-day installations throughout the world. Incidental to the transport of drinking water through the ages has been the foundry industry, whose cast pipe has made it possible to carry large quantities of water.

MAKE REPAIR WELDS ON LARGE GRAY IRON CASTINGS

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CAST IRON WELDING is used almost exclusively for repairing and rebuilding damaged castings. The filling of holes and cracks is the chief use either in the foundry on new castings, or in industry generally on old castings that have become worn and broken. The technique is usually a salvaging operation; the cost of the welding itself is small compared to the benefits received if the operation is successful. Castings ranging from the size of diesel engines to the smallest parts can be welded successfully, although with much more difficulty than, say, mild steel. Although a certain amount of production welding is done in joining parts, this work is usually left to the brazing process.

This paper reports attempts to repair faulty large-size castings, such as diesel engines and hydraulic equipment, at the plant of Dominion Engineering Works Ltd., Lachine, Que. A series of tests was run to determine what could be expected of a cast iron weld, the most suitable equipment, and to train a welder in the technique. It was desired to show that repairs could be made to large castings to meet high strength requirements. The tests, in the main, were successful.

Determine Weld Tensile Strengths

Standard tensile test pieces were obtained from numerous test welds to determine what ultimate tensile strengths can be expected and relied upon in repairs to castings. Two types of cast iron were used to cast the test blocks: DEW (Dominion Engineering Works) No. 1 iron and DEW No. 3 iron, the specifications of which are shown in Table 1. Test blocks were cast of these two irons and bevelled grooves were machined. The groove was welded in, the block was cut into test pieces, and the tensile strengths obtained.

Test Block Types: The first four blocks were 6x5x1½ in. and cast without risers. This set of blocks was found to be porous when the groove was machined in.

The remainder of the test blocks cast were of the same basic size, and a riser 1½ in. wide was cast on the 5-in. width of the block (Fig. 1).

The first four test blocks were grooved in this fashion: 1 in. deep, 10 degree sloping sides, and a width of 1¼ in. across the top of the groove so as to give a U-shaped appearance. The corners were rounded to ¼-in. radius (Fig. 2A). When the test specimens from this type of block proved unsatisfactory, the shape of the groove was changed to 1 in. deep, 1½ in. across the top of the groove, with a 90-degree angle of the V-shape form. Corners were rounded to ⅛-in. radius (Fig. 2B).

Patterns were made of the two shapes of blocks

NOTE: This paper is one of the 1950 prize winners in the Annual Technical Paper Contest sponsored by the A.F.S. Eastern Canada Chapter.

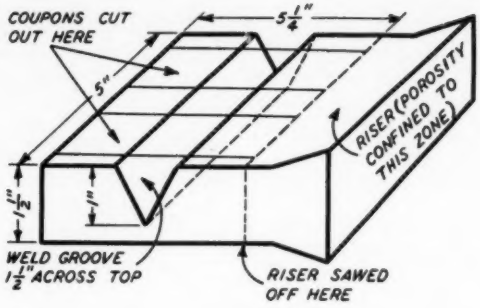


Fig. 1—The dimensions, coupon areas, weld groove and riser locations are shown in sketch of the test block.

used. After casting and cooling, the sand was removed by hydroblasting. The riser section was sawed off so that the final size of the test block was 5 in. by 5¼ in. (Fig. 3A). The groove was machined out parallel to the 5 in. width of the block so that the shrinkage was held outside the welding area.

After welding, two coupons were cut across the weld. These coupons were turned down on the lathe to standard cast iron tensile test pieces (Fig. 3A) in such a manner that both junctions of the cast iron and the weld metal were located on the test pieces. The test pieces were pulled in the tensile machine and the conditions of the fracture noted. Complete test results are shown in the accompanying report.

Test Results From Welded Blocks

Group 1: DEW (Dominion Engineering Works) No. 1 iron used to cast blocks. Tensile strength of iron as-cast into test blocks—20,710 psi. All test blocks porous. U-grooved (Fig. 2A).

Block A: Note: Specimens taken as described in text. Tensile specimen 4364-A-1, ultimate tensile strength, 6250 psi. Tensile

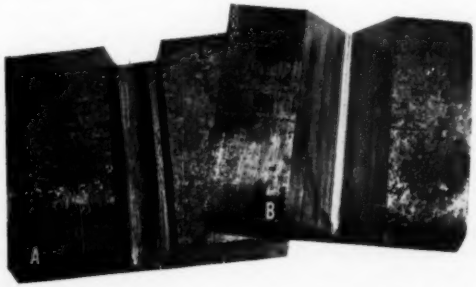


Fig. 2—Weld test grooves used are—(A) U-shape 1¼ in. across top with 10 degree slope sides; and (B) V-shape 1½ in. across top with 45 degree slope sides. Both grooves are 1½ in. deep, and (A) shows porous areas.

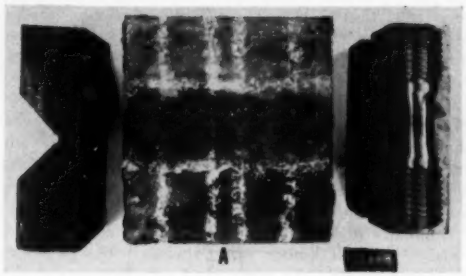
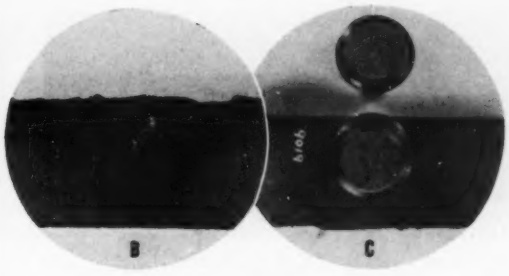


Fig. 3—(A) Welded test block "F" is shown with a standard test piece. (B) Etched surface across the weld in block "F" shows soundness and depth of penetration.



(C) Fracture of test piece cut from block "F" shows the coarse-grain cast iron and the finer weld metal. Fracture is 95% in cast iron and 5% in filler metal.

specimen 4364-A-2, ultimate tensile strength, 10,176 psi. Both fractures were in the weld metal-base metal joint: 80 per cent of the fracture area was cast iron, and 20 per cent was filler metal. Block preheated by torch to 1200 F (estimate) and electric welded using 3/16-in. nickel rod at 180 amps. Weld slightly porous. Cast iron overheated.

Block B: Tensile specimen 4364-B-1, ultimate tensile strength, 1494 psi. Fracture showed 100 per cent iron breaking near weld metal. Tensile specimen 4364-B-2, ultimate tensile strength, 6940 psi. Fracture 100 per cent in cast iron near weld. Block preheated by torch to 1200 F and oxy-acetylene welded using ¼-in. No. 9 rod. No side fusion and some porosity.

Block C: Tensile specimen 4364-C-1, ultimate tensile strength, 9450 psi. Fracture in filler metal-cast iron joint. Block preheated to 1200 F by torch and oxy-acetylene welded using ¼-in. molybdenum-nickel rod. Weld extremely porous.

Group 2: DEW No. 3 iron used to cast blocks. Tensile strength of iron as cast into test blocks, 29,180 psi. Riser used to cast blocks. V-grooved (Fig. 1B).

Block E: Tensile specimen 4364-E-1, ultimate tensile strength, 20,570 psi. Fracture, 10 per cent cast iron, 90 per cent filler metal. Preheated to 1200 F by torch—contact pyrometer used. Oxy-acetylene welded using ¼-in. No. 9 rod. Weld slightly porous.

Block F: Tensile specimen No. 4364-F-1 (Fig. 3C), ultimate tensile strength, 20,570 psi. Fracture, 95 per cent in cast iron, 5 per cent in filler metal. Preheated to 1200 F over charcoal fire. Contact pyrometer and templisticks used to indicate temperature. Welded with oxy-acetylene using ¼-in. rod (Fig. 3).

Block H: Tensile specimen 4364-H-1, ultimate tensile strength, 13,291 psi. Tensile specimen 4364-H-2, ultimate tensile strength, 13,100 psi. In both cases the filler metal broke away from the iron. Welded with 3/16in. nickel rod electric weld. Peened during welding with air hammer. Burned cast iron clearly shown (Fig. 4). Amperage—180.

Block I: Test piece broke during machining. No fusion was obtained. Preheat of 1200 F used with no peening. Electric weld using 3/16-in. nickel rod. Amperage—180.

Block J: Tensile specimen 4364-J-1, ultimate tensile strength, 29,820 psi. Broke entirely in filler metal. Weld quite porous. Tensile specimen 4364-J-2, ultimate tensile strength, 30,760 psi. Fracture 70 per cent in cast iron, 30 per cent in filler metal. This zone not as porous as where first test piece taken. Oxy-acetylene weld using ¼-in. rod.

Group 3: DEW No. 1 iron used to cast blocks. Tensile strength of iron as cast into test blocks, 26,668 psi. All test blocks relatively sound. V-groove used for welding.

Block K: Tensile specimen 4364-K-1, ultimate tensile strength, 24,142 psi. Fracture, 98 per cent in cast iron, 2 per cent in filler metal. Tensile specimen 4364-K-2, ultimate tensile strength, 28,448 psi. Fracture, 60 per cent in cast iron, 40 per cent in filler metal. Preheat of 1200 F used. Charcoal fire and pyrometer used. Oxy-acetylene weld using ¼-in. rod. Some porosity with excellent fusion.

Block L: Tensile specimen 4364-L-1, ultimate tensile strength, 21,320 psi. Fracture 80 per cent in cast iron, 20 per cent in filler metal. Tensile specimen 4364-L-2, ultimate tensile strength 20,782 psi. Fracture, 50 per cent in cast iron, 50 per cent in filler metal. Oxy-acetylene weld using ¼-in. rod for the first pass, and 3/8-in. rod for the remainder. Preheat of 1200 F. Weld very sound.

Group 4: These blocks welded by The Canadian Liquid Air Co. Ltd., DEW No. 3 iron used to cast blocks. Tensile strength of iron as cast into blocks, 36,050 psi. All test blocks sound.

Block S: Tensile specimen 4364-S-1, ultimate tensile strength, 9,090 psi. The metal was cracked in this zone. Tensile specimen 4364-S-2, ultimate tensile strength, 30,552 psi. Fracture entirely in weld metal. Weld porous. Oxy-acetylene welded with ¼-in. rod using a preheat of 1000 F obtained by torch.

Block T: Tensile specimen 4364-T-1, ultimate tensile strength, 31,324 psi. Fracture 90 per cent in cast iron, 10 per cent in filler metal. Tensile specimen 4364-T-2, ultimate tensile strength, 30,552 psi. Fracture entirely in weld metal. Preheat of 1000 F.

NOTE: All the test blocks were cooled by wrapping in asbestos sheets and covering with dry sand. The strength of the iron as-cast into blocks was obtained by taking one block out of each lot cast, and making a standard tensile test piece cut from the iron in the same direction as the test pieces made to obtain the weld tensile strengths.

TABLE 1—RECORD OF TEST BLOCKS CAST FOR WELDING TESTS

Lot No.	1	2	3	4
Quantity	6	8	4	3
Type of Iron	No. 1	No. 3	No. 1	No. 3
Date	June 14	June 23	July 13	July 14
Heat No.	1075	1082	1095	1096
Carbon, %	3.30	3.18	3.26	3.00
Manganese, %	0.78	0.72	0.73	0.82
Silicon, %	2.17	2.07	2.21	1.98
Phosphorus, %	0.458	0.395	0.513	0.306
Sulphur, %	0.108	0.121	0.158	0.138
UTS, psi	34,800	37,300	32,500	47,000
Transverse Beam Load, lb	2139	2028	2428	2822
Transverse Deflection, in.	2318	2156	2217	2502
	28	25	28	34
	32	25	32	29
Resilience, lb/in.	600	508	680	961
	745	540	709	727

DOMINION ENGINEERING WORKS STANDARDS FOR IRON TYPES LISTED ABOVE

Iron	No. 1	No. 3
Carbon Limits, %	3.30-3.50	3.10-3.30
Manganese Limits, %	0.50-0.80	0.60-1.00
Phosphorus Limits, %	0.30-0.50	0.30 max
Sulphur Limits, %	0.15 max	0.15 max
Silicon Limits, %	2.00-2.25	1.70-2.10
Transverse, min. lb	2000	2000
UTS, min. psi	25,000	30,000
BHN	190 max	170-223

Fig. 4—The etched surface through the electric weld on test block "H" shows a burned zone in the iron.

Interpretation of Test Results: Group 1: The test blocks cast were very porous and weak. The shape of the groove was found to be difficult to weld in. All the blocks welded showed evidences of overheating, and fusion was not obtained to any degree. As the results were unsatisfactory, the shape of groove was changed and a charcoal fire instead of a torch was used to preheat the blocks.

Group 2: Decidedly better blocks were cast although some porous areas were evident. A charcoal fire for preheating purposes gave better results; compare J and F with E. Welding was stopped for an interval of a few minutes after each pass to allow the blocks to cool somewhat. A macro-etch was obtained on a slice through the weld zone of block F (Fig. 3B). The extent of fusion may be observed as well as the degree of soundness of the weld. Note the fine grain size of the weld metal as compared with the parent cast iron. An etch was also obtained on a slice through block H. The radical difference between the weld metal and the cast iron may be observed, as well as some areas of "burning" (Fig. 4).

Group 3: Results similar to those of Group 2 were obtained, with block K giving superior results. It is seen that results vary considerably between blocks, although the procedure used has been standardized. The procedure here was virtually the same as for Group 2.

Group 4: These blocks were welded by the Canadian Liquid Air Company Ltd., torch heating to the same preheat temperature. The tensile strength of these blocks was high, and the tensile strength of the welds was correspondingly high, although one area was cracked on one block.

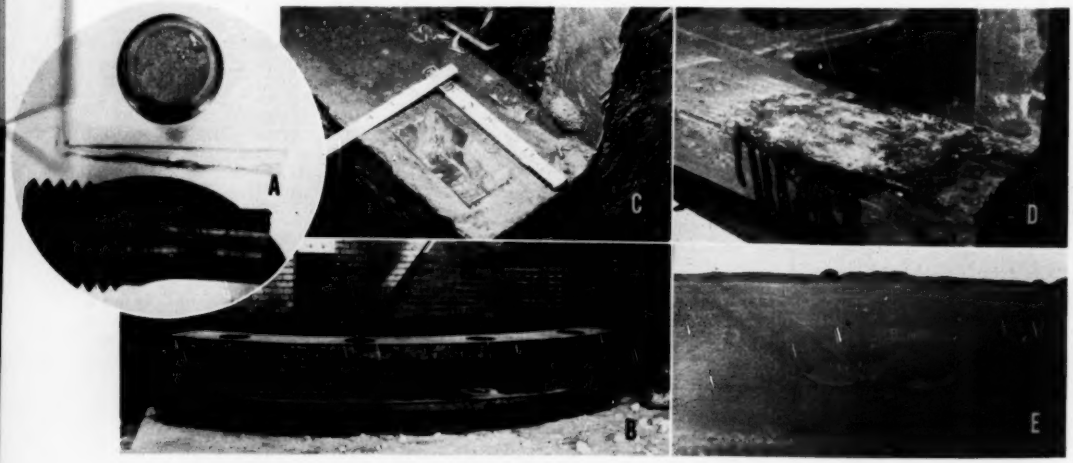
Summary of Test Block Weld Results: The range of tensile strength values on gas-welded blocks varies about 9000 psi. A minimum of 70 per cent of the tensile strength of the base cast iron may be expected of the weld with the average result about 85 per cent. It is felt that if more tests were run on similar blocks consistently higher results would be obtained.

Satisfactory results were not obtained with electric welding. Burning and cracking seem to be the chief troubles. It is pointed out that due to the size of the weld filled in these test blocks, the high temperature of the arc has a great effect. For high strength large welds, oxy-acetylene welding is recommended.

The test block welds accomplished their purpose in that it was shown that high strength welding was possible in performing large welds. As a result, welds were performed on scrapped castings which were later cut up to make test pieces to determine strengths obtainable in practice.

Half-Head Ring Test Weld (Fig. 5): A large scrap hydraulic casting known as a half-head ring was prepared for welding (Fig. 5B). A hole 2x4x1½ in. was chipped out as shown in Fig. 5C, this being done at a heavy section. The casting was heated in a large annealing furnace to 1200F and held at this temperature for about one hour. The casting was pulled out of the furnace far enough to permit welding of the chipped-out section. The exposed parts of the casting were covered with asbestos plates and the partially opened

Fig. 5—(A) Gas holes are shown in the fracture of the tensile test specimen from the weld in the half-head-ring casting. (B) The weld in the half-head-ring casting is at the far right lower heavy section. (C) The chipped out section is ready for welding. (D) The completed weld, and (E) an etched section across the weld.



furnace door was blocked. About two thirds of the length of the casting remained in the furnace. The welding itself took 18 min.

Upon completion of welding the asbestos plates were removed and the casting was replaced in the furnace. The furnace was heated until the oven thermocouples read 1200 F, and then allowed to cool at the rate of 60 F per hour until temperature of 500 F was reached. The fuel was then cut off and the casting allowed to cool in the closed furnace.

After the casting was cool the welded area was ground down even with the rest of the member. No cracks or pinholes were seen on the weld surface. Three blocks were cut from the casting; one included the weld zone, a second included a section similar to the member where the weld was made, and a third was cut from a light web member (Fig. 5B and D).

Ultimate tensile strength test piece made from weld zone and including both junctions between weld metal and cast iron—strength of weld, 28,880 psi (No. 4364-N).

Ultimate tensile strength test piece made from a heavy section similar to that where the weld was performed, with test piece taken in the same plane and in the same direction (two test pieces)—strength of iron (a) 26,678 psi (No. 4364-P); (b) 22,868 psi (No. 4364-O).

Ultimate tensile strength test piece made from light web section—strength of iron (a) 31,888 psi (No. 4364-Q); (b) 29,642 psi (No. 4364-R).

The heavy section is weaker because of more shrinkage effects and slower cooling giving a higher degree of graphitization.

The weld was stronger in tension than the cast iron in a corresponding section although it was slightly porous (Fig. 5E). The value in tension is not far below where the maximum strength iron in the casting is expected in the light web section.

Welding a Diesel Engine Frame: The heavy frame casting of a diesel engine to be used in a high-powered diesel-electric locomotive was repaired without difficulty using the procedures cited. The welding job consisted of three shallow holes of about 3-in. diameter and ¾-in. depth. These holes were due to faulty casting procedure and were chipped out to this size in preparation for welding.

The casting itself weighed over 2½ tons. A procedure similar to that of the previous case was followed. The time schedule follows: time from opening of furnace door to beginning of welding—5 min (this is the time required to bring the casting out of the oven and to arrange the insulation and welding equipment); time of welding—19 min; time from finish of welding to closing of furnace door—3 min.

Conclusion

Although the benefits are obvious, the welding of heavy cast iron castings is not general chiefly because of the unavailability of furnaces large enough to hold large pieces. It has been shown that preheating by torch in the open air is uncertain; using an oven to preheat is generally better. It has been shown that high strength welds are obtainable in the ordinary cast iron materials.

As for comparison with previously published data, no results seem to have been made public on large size work. The tensile strengths obtained in the last series of tests were higher than were expected by the manufacturers of the welding supplies.

The work on cast iron welding is proceeding at Dominion Engineering Works in the hope of obtaining higher strengths and greater reliability. It might be noted that alloy welding rods were not used in the main and investigations will be undertaken using this type of rod. The electric welding results were disappointing, but further work will be done in this field.

Acknowledgments

The author is indebted to A. H. Lewis, metallurgist, and J. Wilcock, chief chemist, Dominion Engineering Works Ltd., and to F. Schneider, technical representative, The Canadian Liquid Air Co., Ltd., for information and assistance given in connection with this article.

Scenes From New England Regional Foundry Conference

At the 10th New England Regional Foundry Conference (story in November issue of AMERICAN FOUNDRYMAN, *page 31), C. A. Wyatt, Debevoise-Anderson Co., Boston, made these pictures of (left) —Impromptu singing by some of the hosts at the conference smoker; (right)—Group from Saco-Lowell Shops, Biddeford, Maine, on steps of building at MIT between technical meetings.*

FOUNDRY EDUCATION . . . .

PAST accomplishments
PRESENT status
FUTURE aims and policies

A REPORT OF THE FOUNDRY EDUCATIONAL FOUNDATION

George K. Dreher
Executive Director
Foundry Educational Foundation
Cleveland

FIVE THOUSAND YOUNG ENGINEERS will be graduated this year from 12 of the nation's outstanding engineering schools. These young men will have had a better look at the foundry industry and will know its products, processes and importance to the world's economy better than any similar group in the history of the metal castings industry.

This increased knowledge and awareness of the potentialities of the castings industry on the part of young engineers is due to the close cooperation between the foundry industry and engineering schools through the agency of the Foundry Educational Foundation, a non-profit organization sponsored by the castings industry and its technical and trade organizations. The ultimate aim of the Foundation is to develop tomorrow's leaders of the foundry industry and to provide future castings customers with a sound knowledge of the advantages of castings as an engineering material.

FEF Program at 12 Schools

To accomplish this, the Foundry Educational Foundation has set up a program at 12 leading engineering schools: University of Alabama, Case Institute of Technology, University of Cincinnati, Cornell University, Massachusetts Institute of Technology, Michigan State College, Missouri School of Mines, Northwestern University Technological Institute, Ohio State University, Pennsylvania State College, Purdue University, and the University of Wisconsin.

Scholarships, Financial Aid Given

The Foundation's program at these 12 schools includes financial assistance or assistance in procuring equipment to round out foundry facilities, close liaison between the foundry industry and educational institutions, to aid engineering schools to adjust their curricula to meet the industry's needs, establishment of scholarships, and a placement service for young engineering students desiring summer work in foundries and for those graduate engineering students desiring to make the foundry a career.

Working in close conjunction with the Foundation at five of the 12 FEF schools—University of Alabama, Massachusetts Institute of Technology, Michigan State College, Missouri School of Mines and Ohio State University—are student chapters of the American Foundrymen's Society. At these schools and at the University of Illinois, University of Minnesota, Oregon State College and Texas A & M College, the A.F.S. Student Chapters provide a meeting ground for engineering students with a common interest—the foundry, by maintaining contact between the student and the foundryman throughout the student's school years, and by providing authoritative speakers on all phases of the castings industry to keep students abreast of latest developments in the industry.

Plan A.F.S. Chapter at Northwestern

Plans are now underway for an A.F.S. Student Chapter at a sixth FEF school, Northwestern Technological Institute, with Bruce L. Simpson, National Engineering Co., Chicago, as Industrial Advisor.

Although the Foundry Educational Foundation has virtually reached the limit of its service capacity with the 12 schools now on its program, its influence will continue to be expanded as follows:

FEF schools will invite inspection of their foundry facilities and instructional methods and will gladly discuss the FEF program and its application with all interested educators from other schools.

Engineering schools and colleges who have previously expressed interest in the work of the Foundation or those schools located in areas where foundrymen have shown interest in the program will be invited to attend the annual meeting of the Foundation's Technical Advisory and University Advisory Committees this coming February.

The Foundation is making a concerted effort to publish literature on its aims, policies and accomplishments through the media of technical and trade magazines and through publications of its founding member societies—American Foundrymen's Society, Gray Iron Founders' Society, Malleable Founders' Society, Foundry Equipment Manfacturers' Association, Non-Ferrous Founders' Society, and the Steel Founders' Society of America.

Along this line, FEF Universities have begun to offer other services beyond instructional and research facilities. These include increasing cooperation in the presentation of foundry conferences and offering their facilities for short courses such as the Sand School con-

ducted by the University of Alabama last spring and the recent Nodular Iron Symposium at Massachusetts Institute of Technology.

One of the year's more important FEF events was the combined meeting of the Technical Advisory Committee and the University Advisory Committee last February. By means of this meeting, educators and foundrymen learned of each others' needs and were provided with a medium by which universities can be apprised of a proper approach to foundry instruction and avoid the onus which usually accompanies the direct recommendations of an industry not familiar with the mechanics of engineering education.

Typifying foundry work in America's engineering colleges and schools is this group of Ohio State University students, shown pouring a mold for a drill stand base. Ohio State University's foundry students keep in close contact with the castings industry through their A.F.S. Student Chapter and participation in Foundry Educational Foundation Program. (Photograph by courtesy of Willys G. Stanton, Jr.)

Shortcomings of the foundry industry, as brought out by the joint committee meeting, were:

1. An unwillingness on the part of foundry executives to visit universities and interview potential additions to their staffs. This should be done in December, January, February, and March. Sudden decisions in May, June or July to add an engineering graduate generally discloses that the best prospects have already been placed.

2. Many companies have training exemptions in their union contracts, but others have neglected to provide for this and as a result are not permitted to train men for supervisory, sales, and managerial positions except when every union employee on the list is already working.

3. Foundrymen in many instances do not as yet understand the nature of an engineering education, the need for added training after graduation, or the need for supplementary study by an engineer in specific fields and the application of engineering talent to their own problems.

4. Many operators of small and medium-sized foundries do not realize the recruiting advantages of keeping continuous contact with students of their selection throughout the student's schooling. The executive of a small or medium-sized foundry has a decided advantage over executives of large organizations in that he can establish personal contact with prospective employees, invite them to inspect his plant and operations, and include them in some of his plant's managerial social functions.

Permanent and Summer Placement

With regard to the 1949-50 collegiate year, 161 graduates registered with the Foundry Educational Foundation have entered the foundry or allied industries and some have returned to school for graduate study of foundry problems. At the same time, more than 200 young men were placed in summer jobs by the Foundation and have returned to school this fall. In addition to these students and graduates, a considerable number of young men, unlisted by the Foundation, have either worked in foundries this summer or have joined the industry as engineers. This represents a healthy growth in the absorption of engineering talent by the foundry industry.

Placement Reaches Limit

On its present basis, the 1949-50 total of students and graduates placed in foundry work represents the limit FEF can handle. Listing graduates and students available to the foundry industry during the 1950-51 collegiate year will be accomplished with the aid of local foundry groups and industrial advisory committees at FEF schools. This listing will be based on a system worked out last year at the University of Wisconsin, whereby brief biographies of prospective summer workers were listed and distributed to foundries in the Wisconsin area.

In three years, the Foundry Educational Foundation has placed 468 engineering school graduates in the foundry and allied industries and 497 in summer jobs in foundries. Although these students are from 35 universities, in excess of 85 per cent are from the 12 FEF schools.

Introduce Foundry College Textbooks

With regard to teaching aids in engineering schools and colleges, the first college level textbook, *Fundamentals in the Production and Design of Castings*, was published during the past year by Professor C. T. Marek of Purdue University. An A.F.S. sponsored college foundry textbook is in preparation by Professor Peter E. Kyle of Cornell University. An excellent foundry section will also be included in a book to be published this fall. Written by members of the mechanical engineering staff of the Massachusetts Institute of Technology, this text will feature a foundry section by Professor Howard F. Taylor.

Most FEF universities have developed mimeographed course outlines for foundry students. Most recent of these is a *Foundry Course Outline*, prepared by Professor R. W. Heine and the metallurgi-

cal engineering staff of the University of Wisconsin and available for national distribution at $1.25 per copy. This outline applies to the first phase of a college foundry course, defined by FEF as General Engineering Interest. Succeeding courses are Specification, Use and Design; Engineering Management and Technology; Graduate Instruction and Thesis Work; and Research, Development, and Consulting by University Staffs and Laboratories.

FEF universities now have foundry laboratories that are well-equipped and staffed and can serve as models for other universities interested in developing foundry facilities. Among these are Cornell University's newly-completed laboratory, built with the advice and assistance of New York foundrymen. Active interest of the foundry industry in engineering education is responsible for a very fine foundry layout to be installed in Massachusetts Institute of Technology's new Mechanical and Metallurgical Engineering building.

College Foundry Laboratories Praised

Among the finest of university foundry engineering facilities is the newly-opened Foundry Laboratory at the University of Alabama. Birmingham district foundrymen and industrialists, the Foundry Educational Foundation, university officials, and members of the A.F.S. Birmingham District Chapter contributed foundry know-how, financial assistance, and casting equipment to creation of the laboratory. Similar interest on the part of Indiana foundrymen is responsible for an appropriation of $120,000 by Purdue University for expansion and modernization of the university's foundry facilities. Another excellent foundry laboratory is being developed at Ohio State University, and the University of Wisconsin's Foundry Laboratory is known throughout the country for its good foundry housekeeping practices.

In addition to standard undergraduate courses in foundry technology, graduate work is now available at Massachusetts Institute of Technology, Case Institute of Technology, Ohio State University, University of Alabama, Purdue University, University of Wisconsin, Michigan State College, and the University of Cincinnati.

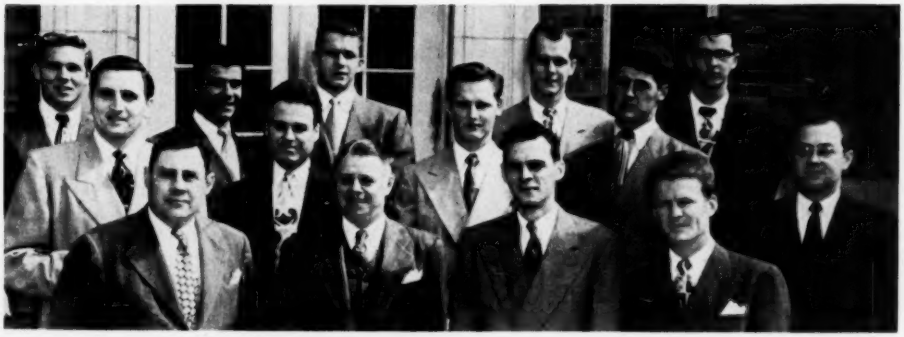
Effect of Draft Laws on Students

Work is now going forward in Washington to devise new laws or adjustments to present military training laws. Some points under consideration include a definite division of talent between the military and industry, with particular regard to college graduates; incorporation of military training requirements into college curricula; guaranteeing worthy but needy students an opportunity to continue their studies; and speeding-up of college study programs through elimination of extended vacation periods.

In the event that these laws are passed, it is obvious that the foundry industry is maintaining through the Foundry Educational Foundation, a program that will insure that the industry will obtain its share of engineering talent.

Present rebuilding of the nation's Armed Forces and continuation of present or enactment of more drastic draft laws because of the current tense international situation could seriously affect student engineering personnel but on the other hand would emphasize the value of trained foundry engineering personnel in any future mobilization of American industry.

FEF Scholarship Winners At Missouri School of Mines



Shown with faculty members are 11 metallurgical and mechanical engineering students at Missouri School of Mines who have been awarded Foundry Educational Foundation scholarships for 1950-51. Left to right, front row: A.F.S. Student Chapter Faculty Advisor D. S. Eppelsheimer, professor of metallurgy; Dean Curtis L. Wilson, George W. Sullivan, Joe L. March. Second row: William J. Ruprecht, Wade C. Wurtz, Gillum E. Burgess, Leland D. Beverage and Albin B. Charneski. Third row: Jack M. Wheeler, James Salmas, Robert E. Schuchardt, MSM Instructor in Metallurgy George H. Wagner and Norbert F. Neumann. Not shown in this photograph is Edward W. Cawthorne of Greentree, Pa., who was awarded a scholarship but was recalled to military service.

WHO'S WHO

F. R. Morral

F. R. Morral, whose *"Nodular Iron — A Bibliography"* on Page 43, is the second of two articles on the subject published in AMERICAN FOUNDRYMAN — the first having appeared in the July, 1950, issue, is associate professor of Materials Engineering at Syracuse University . . . Educated in the United States, Sweden and in Spain, Dr. Morral has been associated with research and development in several U. S. foundries and with universities in Pennsylvania and in Spain . . . He has written some 50 technical articles published in English, Swedish and Spanish.

C. E. Wenninger

C. E. Wenninger, author of *"Foundry Sand — Getting Down to Fundamentals,"* Page 45, is foundry instructor, University of Kentucky . . . He entered the foundry industry as a chemist for Crawford Steel Foundry Co., Bucyrus, Ohio, in 1940, remaining there for five years, when he was named assistant superintendent for Standard Steel Works Foundry, Lewistown, Pa. Returning to Crawford Steel, he became chief metallurgist there for three years, then acted as consultant to Steel Founders Society of America for a year before assuming his position at Kentucky in 1949. He is a member of the A.F.S. Sand Division's Committee on Flowability.

J. J. McClain

J. J. McClain, author of *"Modern Foundry Methods—Plaster Molding for Precision Casting Put on Production Basis,"* Page 36, is chief foundry engineer, Light Alloys, for Fabricast Division, General Motors Corp., Bedford, Ind. . . . Holder of a B.S. from the University of Detroit in 1933, Mr. McClain joined Ford Motor Co. that same year as research chemist and physicist. After serving as an investigator for the State of Ohio in 1938 and 1939 and as chemist and metallurgist for Delco-Remy Div., GMC, from 1939 to 1945, Mr. McClain joined GMC's Fabricast Div. in his present position in 1945.

J. H. Walsh

John H. Walsh, whose article *"Make Repair Welds in Large Gray Iron Castings"* on Page 52, won one of the top prizes in Eastern Canada Chapter's Technical Papers Contest, is metallurgical engineer for Dominion Engineering Works, Lachine, Que. . . . A graduate of McGill University, where he held the Sir William Dawson Fellowship in Metallurgy, and where he is now working on his master's degree in Metallurgy, Mr. Walsh has served as metallurgist with several prominent Canadian foundries and allied industries.

S. F. Carter

Sam F. Carter, author of *"Basic Lined Cupola Permits Use of Lower Grade Scrap and Coke,"* Page 50, is assistant melting superintendent, American Cast Iron Pipe Co., Birmingham, Ala. . . . Holder of a B.S. from Birmingham Southern College and an M.S. from the University of Wisconsin, Mr. Carter has been with ACIPCO throughout his foundry career . . . He has published several articles on ferrous melting in technical magazines.

W. F. Bohm

Walter F. Bohm, author of *"Mold Materials are Factors in Gray Iron Shrinkage,"* Page 26, is metallurgist for Buick Motor Division, General Motors Corp., Flint, Mich. Holder of a B.S. in Metallurgical Engineering from Columbia University in 1941, Mr. Bohm joined Buick that same year as metallurgist . . . Active for several years in A.F.S. chapter work, Mr. Bohm has spoken before chapter and national meetings of the Society on melting of gray iron.

G. K. Dreher

George K. Dreher, who reports progress of the Foundry Educational Foundation in *"Foundry Education — Past, Present and Future,"* Page 56, is Executive Director of FEF . . . A past National Director of A.F.S., Mr. Dreher has for many years been active on A.F.S. Committees, particularly in the educational field . . . After serving as an executive in Wisconsin and California foundries, Mr. Dreher became FEF's first Executive Director in 1947 . . . In addition to his many other A.F.S. activities, Mr. Dreher is a past chairman of the A.F.S. Wisconsin Chapter.

Connecticut NFFA Hears Talk On Coreblowing

CLOSE CONTROL over the variables in coremaking through use of coreblowers was the theme of a talk by T. J. Magnuson, Champion Foundry & Machine Co., Chicago, on "Developments in Coreblowing" at the October 18 meeting of the Connecticut Non-Ferrous Foundrymen's Association, held at East Haven.

In the past, Mr. Magnuson said, almost any kind of washed and dried silica sand was considered good enough for making cores, but today it is necessary to impose rigid controls over coremaking practices to meet competitive markets.

Gray Iron Research Operators Elect

TWO DAY ANNUAL MEETING of the Operators' Group of the Gray Iron Research Institute, held recently at Vassar and Saginaw, Mich., was attended by 75 members of the Institute.

Meeting program included visits to Eaton Mfg. Co's Foundry Division, Vassar, and the Chevrolet Grey Iron Foundry at Saginaw, technical meetings and election of the following officers for 1950-51:

Chairman, Erwin Deutschlander, Worthington Pump & Machinery Corp., Buffalo; *vice-chairman*, J. L. Brooks, Sparta Division, Muskegon Piston Ring Co.; and *secretary*, H. W. Lownie, Jr., Battelle Memorial Institute, Columbus, Ohio. Elected to the Group's Research Committee were: A. W. Schneble, Advance Foundry Co., Dayton, Ohio; S. C. Clow, James B. Clow & Sons, Coshocton, Ohio; and A. D. Barczac, Superior Foundry, Inc., Cleveland.

NEW SUSTAINING MEMBERS

Staver Foundry Co., Virginia, Minn.—John F. Staver, Pres. (Twin City Chapter)—Conversion from Company.

NEW COMPANY MEMBERS

Philadelphia Coke Co., Philadelphia, Pa.—Donald MacBrien, Ind. Engr. (Philadelphia Chapter).

Lenoir Car Works, Lenoir City, Tenn.—Henry Marius, Mgr. (Tennessee Chapter).

Magnesium Alloy Products Co., Compton, Calif.—L. M. Nash, Prod. Mgr. (So. California Chapter)—Conversion from Personal.

BRITISH COLUMBIA CHAPTER

Manuel Beck, Core Room Fmn., Vancouver Engr. Works, Ltd., Vancouver, B. C., Canada.
Howard H. Havies, Fdy. Sales, Vivian Diesels & Munitions Ltd., Vancouver, B. C., Canada.

CANTON DISTRICT CHAPTER

Donald L. McLeod, Sales Repr., Ohio Ferro Alloys Corp., Canton, Ohio.

CENTRAL ILLINOIS CHAPTER

Ernest L. Butts, Appr., Caterpillar Tractor Co., Peoria, Ill.
A. J. Draper, Fmn., Caterpillar Tractor Co., Peoria, Ill.
Jesse D. Moore, Caterpillar Tractor Co., Peoria, Ill.
John W. Roseberry, Appr., Caterpillar Tractor Co., Peoria, Ill.
John J. Shellaberger, Sales Engr., Wagner Malleable Iron Co., Decatur, Ill.
Donald A. Wise, Fmn., Caterpillar Tractor Co., Peoria, Ill.

CENTRAL INDIANA CHAPTER

Reese Leisen, Molding Supv., Swayne, Robinson & Co., Richmond, Ind.
Paul Stikeleather, Molding Supv., Swayne, Robinson & Co., Richmond, Ind.

CENTRAL MICHIGAN

Arthur L. Eascott, Treas., Albion Malleable Iron Co., Albion, Mich.
James F. Anderton, Pres., Simon Iron & Steel Corp., Lansing, Mich.

CENTRAL NEW YORK

Robert L. Chambers, Sales Repr., Swan-Finch Oil Corp., Fayetteville, N. Y.

CHICAGO CHAPTER

John Joseph Byrnes, Student-Mech. Engr., Northwestern Tech. Inst., Evanston, Ill.
Henry F. Ciszewski, Sand Tech., Hansell-Elcock Co., Chicago.
Herman C. Inlow, Assoc. Chemist, Cities Service Oil Co., East Chicago, Ind.
John W. Lauder, Met., Aurora Metal Co., Aurora, Ill.
Mark Oganovac, Fmn., Cleaning Dept., Hansell-Elcock Co., Chicago.
Paul A. Schroeder, Ind. Engr., Kensington Steel Co., Chicago.
William S. Varrige, Fmn., Hansell-Elcock Co., Chicago.

CINCINNATI DISTRICT CHAPTER

Homer Dick Lewis, Student, University of Cincinnati, Cincinnati.
Richard A. Wolfe, Student, University of Cincinnati, Cincinnati.

DETROIT CHAPTER

George F. Bobier, Plant Engr., Wilson Fdy. & Mach. Co., Pontiac, Mich.
Casper J. Elston, Sales Repr., Joseph Dixon Crucible Co., Detroit, Mich.
Alden W. Gallup, Sales Repr., Hanna Furnace Corp., Detroit, Mich.
Leslie Haney, Pattern Rigging & Layout, Michigan Steel Casting Co., Detroit.
True Hayford, Gen. Fmn., Ford Motor Co., Dearborn, Mich.
Victor W. Valaska, Supv. of Standards, Wilson Fdy. & Mach. Co., Detroit.
Caswell E. Williams, Gen. Fmn., Ford Motor Co., Dearborn, Mich.

EASTERN CANADA CHAPTER

James Begbie, Molder, Union Screen Plate Co., Lennoxville, Que., Canada.
Ralph Cathcart, Prod. Mgr., Can. Unitcast Steel Ltd., Sherbrooke, Que., Canada.
Adelard J. Cote, Supt. Pattern Maker, Union Screen Plate Co., Lennoxville, Que., Canada.
Alexandre Maurice DesHayes, Engr., Dottau Produits Fonderies, Montreal, Que., Canada.
Sylvio Doyon, Chemist, Can. Unitcast Steel Ltd., Sherbrooke, Que., Canada.
David George Evans, Canadian Car & Foundry Co., Longue Pointe, Que., Canada.
George Houison, Pattern Shop Fmn., Canadian Car & Foundry Co., Longue Pointe, Que., Canada.
Paul Jacques, Process Dev. Engr., Crane Ltd., Montreal, Que., Canada.
George King, Head Melter, Canadian Unitcast Steel Ltd., Sherbrooke, Que., Canada.
Eric T. Jackalin, Engr., Canadian Car & Fdy. Co., Longue Pointe, Que., Canada.
Patrick Maguire, Molder, Union Screen Plate Co., Lennoxville, Que., Canada.
Thomas Niven, Jr., Chief Fdy. Insp., Canadian Car & Foundry Co., Longue Pointe, Que., Canada.
Harry Snutch, Canadian Car & Foundry Co., Longue Pointe, Que., Canada.
Reginald Snutch, Asst. Supt., Cleaning Shop, Canadian Car & Foundry Co., Longue Pointe, Que., Canada.

EASTERN NEW YORK

Raymond C. Willey, Fdy. Standards, General Electric Co., Schenectady, N. Y.

METROPOLITAN CHAPTER

Charles P. Isleib, Met., International Nickel Co., Res. Lab., Bayonne, N. J.
Warren McLellan Spear, Met., International Nickel Co., Bayonne, N. J.

MEXICO CITY CHAPTER

Horacio Escamilla Castro, Appr., Hojalata Y Lamina, S.A., Monterrey N. L., Mexico.
Charles A. Green, Productos Ind. de Parrae, Parrae, Chih., Mexico.
Ubaldo Alcala Ruesga, Estudiante de Quimico Met., Mexico, D. F. Mexico.
Fernando G. Solana, Mgr., Dist. La Concepcion, Puebla, Pue, Mexico.
Pedro C. Torres, Fdy. Fmn., International Harvester Co. of Mexico, S. A. Saltillo, Coahuilla, Mex.
Frank J. Zmarzly, Supt., International Harvester Co. of Mexico, S. A. Artego Saltillo, Mexico.

MICHIANA CHAPTER

John G. Farabaugh, Asst. Fdy. Supt., Oliver Corp., South Bend, Ind.
Glen Harrington, Fdy. Engr., Oliver Corp., South Bend, Ind.
Harris E. Heater, Gen. Fmn., Oliver Corp., South Bend, Ind.
Harry Z. Longenecker, Supv. Mall. Core Room, Oliver Corp., South Bend, Ind.
W. S. Miller, Gen. Fmn., Oliver Corp., South Bend, Ind.
John J. McAntee, Owner, John J. McAntee Sales & Service, Benton Harbor, Mich.
Frank Piechorowski, Fmn., Oliver Corp., South Bend, Ind.
Clarence Prue, Core Fmn., Oliver Corp., South Bend, Ind.
John Sokola, Fmn., Oliver Corp., South Bend, Ind.
John Turoff, Fdy. Fmn., Oliver Corp., South Bend, Ind.
Norman E. Williams, Fdy. Engr., Oliver Corp., South Bend, Ind.
Lyle L. White, Fdy. Engr., Oliver Corp., South Bend, Ind.
Clinton E. Westin, Chief Met., Superior Steel & Malleable Cstgs. Co., Benton Harbor, Mich.

MO-KAN CHAPTER

Everett E. Armstrong, Partner, Fairfax Foundry, Kansas City, Kansas.
William R. Blatt, Appr., Fairfax Foundry, Kansas City, Kansas.
Bramwell G. Case, Office Mgr., American Brake Shoe Co., Kansas City, Mo.
L. A. Harrison, Repr., Mexico Refractories Co., Kansas City, Mo.
Gus Basil Madouros, Partner, Fairfax Foundry, Kansas City, Kansas.
R. E. Normandie, Vice Pres., Standard Brass Mfg. Co., Kansas City, Mo.

NORTHEASTERN OHIO CHAPTER

Donald R. Covey, Sales Engr., Peerless Mineral Products Co., Conneaut, Ohio.
Malcolm Fitrell, Core Room Fmn., Ohio Fdry., Cleveland.
Fred Kitchen, Salesman, Mau Sherwood Supply Co., Cleveland.
George Lundberg, Asst. Mgr., Mach. Div., Osborn Mfg. Co., Cleveland.
Strogonow Nikolai, Supv., Superior Fdy., Inc., Cleveland.
Earl B. Smith, Sales Engr., Osborn Manufacturing Co., Cleveland.
James J. Whelan, Treas., Allyne Ryan Fdy. Co., Cleveland.

NORTHERN CALIFORNIA CHAPTER

Cecil J. Allen, Scrap Control Supv., General Metals Corp., Oakland, Calif.
Donald L. Barringer, Sand Control Supv., General Metals Corp., Oakland, Calif.
M. Camacho, Molding Fmn., General Metals Corp., Oakland, Calif.
John G. Campbell, Shipping, Pacific Steel Casting Co., Berkeley, Calif.

James Cassidy, Coreroom Fmn., General Metals Corp., Oakland, Calif.
Frank E. Costa, Furnace Tender, General Metals Corp., Oakland, Calif.
Arthur De Caney, Fmn., General Metals Corp., Oakland, Calif.
Roger W. Dexter, Pres., Dexter Metal Treating Co., Oakland, Calif.
Frank E. Dunlap, Fmn., Patternmaker, General Metals Corp., Oakland, Calif.
Kenneth S. Gehrig, Prod. Clerk, General Metals Corp., Oakland, Calif.
Richard D. Genger, Radiologist, Pacific Steel Casting Co., Berkeley, Calif.
William H. Hay, Asst. to Supt., Mall. Iron Fdy., General Metals Corp., Oakland, Calif.
Alfred Jason Supv., Coreroom, General Metals Corp., Oakland, Calif.
Edward L. Leal, Pouring Fmn., General Metals Corp., Oakland, Calif.
Manuel Lema, Molding Fmn., General Metals Corp., Oakland, Calif.
Aaron Loomis, Molding Fmn., General Metals Corp., Oakland, Calif.
Wilbert H. Olson, Supt., General Metals Corp., Oakland, Calif.
Gordon W. Palmquist, Mgr., Knute Palmquist Fdy., Oakland, Calif.
Stephen Panich, Metal Castings Sales, General Metals Corp., Oakland, Calif.
Attilio P. Pelosi, Maint. Fmn., General Metals Corp., Oakland, Calif.
Harold Charles Ring, Pattern Fmn., General Metals Corp., Oakland, Calif.
Ernest D. Roberts, Shipping Fmn., General Metals Corp., Oakland, Calif.
George A. Schimmelpfennig, Fdy. Supt., California Foundries, Inc., Oakland, Calif.
Leonard E. Silvey, Melting Fmn., General Metals Corp., Oakland, Calif.
Theodore Tompach, Patternmaker, General Metals Corp., Oakland, Calif.
Fred Ulrich, General Metals Corp., Oakland, Calif.

NORTHWESTERN PENNSYLVANIA CHAPTER

David A. Fourspring, Asst. Fdy. Supt., Standard Stoker Co., Inc., Erie, Pa.
Alexander M. Wightman, Pres., The Lakes Laboratories, Erie, Pa.

ONTARIO CHAPTER

J. W. Pawley, Works Mgr., London Concrete Machinery Co. Ltd., London, Ont., Canada.
Col. J. M. Pocock, Vice Pres., London Concrete Mach. Co. Ltd., London, Ont., Canada.
Donald Barnes, Student, University of Toronto, Toronto, Ont., Canada.
J. W. Bell, Works Met. & Chief Insp., Alum. Co. of Canada Ltd., Toronto, Ont., Canada.
Peter S. Dewar, Asst. Engr., Ford Motor Co. of Canada Ltd., Windsor, Ont., Canada.
Denis A. Dodson, Gen. Mgr., Foundry Services (Canada) Ltd., Toronto, Ont., Canada.
Peter Gordon, Fdy. Consultant, J. R. Short & Co., Toronto, Ont., Canada.
John A. Madden, Sls. Engr., Aluminum Co. of Canada, Ltd., Toronto, Ont., Canada.
Charles Marshall, Fdy. Supt., Dominion Wheel & Fdy. Ltd., Toronto, Ont., Canada.
Wm. Meathrel, Supt., London Concrete Mach. Co. Ltd., London, Ont., Canada.

OREGON CHAPTER

Darwin H. Wissenback, Cost Engr., Crawford & Doherty Fdy. Co., Portland, Oregon.

PHILADELPHIA CHAPTER

Robert L. Dollar, Furnace Fmn., Bethlehem Steel Co., Bethlehem, Pa.
Joseph F. Best, Fmn., Frankford Arsenal, Philadelphia, Pa.
Clarence H. Cline, Gen. Fdy. Fmn., Palmyra Fdy. Co., Inc., Palmyra, N. J.
Philadelphia Coke Co., Philadelphia, Pa., Donald MacBrien, Ind. Engr.
John Thomas Mooney, Asst. Met., Dodge Steel Co., Philadelphia, Pa.
James H. Stewart, Asst. to Pres., Reading Gray Iron Cstgs. Co., Reading, Pa.
Wilbur A. Radar, Gen. Fmn., Brass Fdy. Bethlehem Steel Co., Bethlehem, Pa.
Harry J. Timmons, Asst. Sales Mgr., Palmyra Fdy. Co., Inc., Palmyra, N. J.
Robert N. Voigt, Res. Mgr., U. S. Pipe & Foundry Co., Burlington, N. J.

ROCHESTER CHAPTER

Joseph Di Norma, Molder, Anstice Co. Inc., Rochester, N. Y.
Mel Myles, Supt., Rochester Bronze & Aluminum Co., Rochester, N. Y.
Earl H. Ogden, Engr., Rochester Smelting & Refining Co. Inc., Rochester, N. Y.

SAGINAW VALLEY CHAPTER

Walter Wyrick Walker, Buick Motor Co., G.M.C., Flint, Mich.
Jack B. Bisanz, Student, General Motors Institute, Flint, Mich.
Joseph C. Bourcier, Supv., Central Fdy. Div., G.M.C., Saginaw, Mich.
William C. Schartow, Personnel Dir., Chev. Grey Iron Fdy., G.M.C., Saginaw, Mich.
Delbert E White, Student, General Motors Inst., Flint, Mich.

ST. LOUIS DISTRICT CHAPTER

Hal Roach, Sales Repr., Laclede-Christy Co., St. Louis.
Charles P. Luckie, Asst. Sales Mgr., American Smelting & Refining Co., St. Louis.

SOUTHERN CALIFORNIA CHAPTER

John P. Battena, Met., Magnesium Alloy Products Co., Compton, Calif.
Earle W. Deeble, Sales Engr., Dayton Fdy., Fullerton, Calif.
E. E. Fratello, Jr., Supt., Ampco Metal, Inc., Burbank, Calif.
John Gerwig, Core Room Fmn., Magnesium Alloy Products Co., Compton, Calif.
Walter Heinemann, Asst. Mgr. of Sales, Spec. Prods., Columbia Steel Co., Los Angeles.

TENNESSEE CHAPTER

Roy H. Baker, Fmn., Steel Fdy., Lenoir Car Works, Lenoir City, Tenn.
S. H. Ellison, Fmn., Brass Fdy., Lenoir Car Works, Lenoir City, Tenn.
Lenoir Car Works, Lenoir City, Tenn., Henry Marius, Mgr.

TEXAS CHAPTER

R. Richard Hirsch, Sales Repr., Lone Star Steel Co., Dallas, Texas.
Rufus C. Somerville, Sales Repr., Lone Star Steel Co., Dallas, Texas.

TWIN CITY CHAPTER

Joseph B. Hnasko, Jr., Fmn., Mpls. Moline Co., Minneapolis.
Louis M. Lund, Jr., Asst. Met., The Werner G. Smith Co., Minneapolis.
Edward Olson, Fdy. Fmn., R.R. Howell Co., Minneapolis.
Wilton C. Prior, Supv., Mpls. Moline Co., Minneapolis.

WESTERN MICHIGAN

J. O. Funkhouser, Sales, Campbell, Wyant, & Cannon Fdy. Co., Muskegon, Mich.
Norman Noordeloos, Lubrication Engr., Cities Service Oil Co., Grand Rapids, Mich.

WESTERN NEW YORK

Harold A. Andersen, Met. Engr., Electro Refractories & Alloys, Buffalo, N. Y.
Francis A. Bade, Jr., Asst. to Gen. Supt., American Radiator & Stand. Sanitary Corp., Buffalo, N. Y.
F. Kerfoot Sowers, Asst. to Pres., Milward Alloys Inc., Lockport, N. Y.
Walter W. Steiner, Asst. to Melting Supt., Worthington Pump & Mach. Corp., Buffalo, N. Y.
Alfred G. Schutrum, Cleaning Room Fmn., Worthington Pump & Mach. Corp., Buffalo, N. Y.

WISCONSIN CHAPTER

Tom E. Armstrong, Barclay Foundry, Inc., Milwaukee.
Emile O. Blain, Sales, Bay State Abrasive Products Co., Milwaukee.
Robert J. De Broux, Salesman, Milwaukee Chaplet & Mfg. Co., Milwaukee.
Fred J. Geboy, Asst. Supt., Lawran Fdy. Co., Milwaukee.
Frank Kalcich, Pattern Clerk, Grede Foundries, Inc., Milwaukee.
Donald J. Madden, Appr., Bucyrus-Erie Co., Milwaukee.
Carl F. Mantey, Est. & Time Study Man, Grede Foundries, Inc., Milwaukee.
James Murdoch, Personnel Mgr., Grede Foundries, Inc., Milwaukee.
Charles Nimmer, Core Fmn., Grede Foundries, Inc., Milwaukee.
A. J. Payleitner, Barclay Foundry, Inc., Milwaukee.
N. F. Payleitner, Barclay Foundry, Inc., Milwaukee.
Sam Sahagion, Appr., Bucyrus-Erie Co., Milwaukee.
Richard R. Simonovich, Student, University of Wisconsin, Madison, Wis.
Ernest R. Warner, Prod. Mgr., Grede Foundries, Inc., Milwaukee.
James G. Weber, Vice-Pres., Walter Gerlinger, Inc., Milwaukee.
Richard L. Williams, Student, University of Wisconsin, Madison, Wis.

STUDENT CHAPTERS

M.I.T.

Gerard W. Poirier Mark R. Thompson

MICHIGAN STATE COLLEGE

William H. Ferguson, Jr. Gerald Klinger Joseph Ryan

MISSOURI SCHOOL OF MINES

Sylvester T. Algermissen Leonard Bieri, Jr. Thomas Eichenberger
Gene John Hawker Don Meiners Jack M. Wheeler

OREGON STATE COLLEGE

Larry D. King David D. Parker

TEXAS A. & M.

Freddy Adickes B. D. Adair L. D. Fisher
Delmar S. Hilliard Lee R. Howard William E. Johnston
Emilio J. Sandoval E. Duan Scott Robert Wolslegel

UNIVERSITY OF ILLINOIS

Paul Mark Hassler

UNIVERSITY OF MINNESOTA

Thomas H. Tyvand

INTERNATIONAL

England

Kenneth Thomas James Bone, Director, Alliance Fdy. Co. Ltd., Eastbourne, England.
Harry Ellis, Met. Consultant, Market Harborough, Leics., England.
Ferro Enamels Ltd., Wombourne, Wolverhampton, Staffordshire, England.

The Netherlands

F. W. E. Spies, Mgr., Kon. Ned. Hoog Staal, Yelsen-Noord, The Netherlands.

Africa

Koloman Schedivetz, Mech. Engr., Fdy. Mgr., Gearing & Fameson Lt., Newlands (Cape Prov.), Union of So. Africa.
Union Miniere du Haut-Katanga, Elisabethville, Belgian Congo.

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Valley Iron Works, Inc.
St. Paul, Minn.
Chairman
Twin City Chapter

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Vassar Electric Products, Inc.
Vassar, Mich.
Director
Saginaw Valley Chapter

Noel A. Baker
Star Pattern & Mfg. Co.
Benton Harbor, Mich.
Director
Michiana Chapter

William J. Cannon
The Nugent Sand Co.
Muskegon, Mich.
Treasurer
Western Michigan Chapter

H. R. Rost
Allied Chemical & Dye Corp.
Cincinnati
Treasurer
Cincinnati District Chapter

B. D. Herrington
Hickman, Williams & Co.
Erie, Pa.
Membership Chairman
No. Western Pennsylvania Chapter

Charles Saunders
Tenn. Products & Chem. Corp.
Nashville, Tenn.
Director
Tennessee Chapter

Robert F. Thomson
International Nickel Co.
Detroit
Director
Detroit Chapter

Wm. Morley
Link-Belt Co., Olney Foundry Div.
Philadelphia
Director
Philadelphia Chapter

Gerald E. Smith
East Texas Electric Steel Co.
Longview, Texas
Director
Texas Chapter

Herman Bohr, Jr.
Robbins & Bohr
Chattanooga, Tenn.
Secretary-Treasurer
Tennessee Chapter

Arthur E. Falk
Centrifugal Casting Co.
Long Beach, Calif.
Director
Southern California Chapter

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West. Mich. Steel Fdry. Co.
Muskegon, Mich.
Director
Western Michigan Chapter

Kenneth R. Proud
Anstice Co., Inc.
Rochester, N. Y.
Chairman
Rochester Chapter

A. Jack Moore
Montreal Bronze, Ltd.
Montreal, Can.
Membership Chairman
Eastern Canada Chapter

Robert H. Jacoby
Key Co.
East St. Louis, Ill.
Treasurer
St. Louis District Chapter

Herbert J. Cooper
The Cooper Alloy Foundry Co.
Hillside, N. J.
Director
Metropolitan Chapter

John R. Russo
Russo Foundry Equipment Co.
Oakland, Calif.
President
Northern California Chapter

E. C. Meagher
Federal Foundry Supply Co.
Milwaukee
Director
Wisconsin Chapter

Jack F. Secor
Hill & Griffith Co.
Niles, Mich.
Chairman
Central Michigan Chapter

Lewis T. Crosby
Sterling Wheelbarrow Co.
Cleveland
Director
Northeastern Ohio Chapter

Carl L. Dahlquist
Greenlee Bros. & Co.
Rockford, Ill.
Vice-Chairman
No. Ill.-So. Wis. Chapter

Wm. Ziegelmueller
Electric Steel Castings Co.
Speedway City, Ind.
Director
Central Indiana Chapter

J. M. Snyder
Jos. Musto Sons, Keenan Co.
Oakland, Calif.
Director
Northern California Chapter

FOUNDRY *Personalities*

Walter E. Haase, formerly with the L. J. Mueller Furnace Co. and the H. E. Bremer Mfg. Co., both of Milwaukee, has joined Robert C. Penner in the Interstate Supply & Equipment Co., Milwaukee, purchased early in 1950.

Charles Locke, formerly with Armour Research Foundation of the Illinois Institute of Technology, Chicago, was recently named works manager for Atlas Foundry & Machine Co., Tacoma, Wash. Mr. Locke is chairman of the A.F.S. Steel Division and has for many years been active in A.F.S. technical committee work.

Charles Locke

Robert Shaffer has been appointed special foundry industry representative for Buckeye Tools Corp., Dayton, Ohio. Mr. Shaffer was formerly associated with Dayton Steel Foundry, Dayton, Ohio, for 32 years, the last 16 of them as foundry superintendent, a director of the company and assistant factory manager. He will work with Buckeye representatives in several Midwestern and Eastern states.

Frank M. Hall, since 1942 assistant plant superintendent for Acheson Colloids Corp., Port Huron, Mich., has been named plant superintendent, succeeding **Alfred E. Emms,** who retired in October. Mr. Hall was first employed by Acheson in 1919 on production work and in 1934 was promoted to foreman and in 1942 assistant plant superintendent at Port Huron.

Dr. Samuel L. Hoyt, technical advisor on metallurgical problems to Battelle Memorial Institute, Columbus, Ohio, was recently awarded the University of Minnesota's Outstanding Achievement Medal for his research on hard carbides and his work as advisor to Battelle. Dr. Hoyt, who founded the University of Minnesota's Department of Metallurgy, undertook research that led to development of cemented tungsten carbide, a superior tool material for cutting operations. He was the AIMME Lecturer in 1930, the ASM Campbell Memorial Lecturer in 1940, and the American Welding Society's Adams Lecturer in 1945.

S. C. Massari

S. C. Massari, Technical Director, American Foundrymen's Society, has been elected chairman of Metals Engineering Division, American Society of Mechanical Engineers.

Willis M. Pierce, assistant to the general manager of the technical department, New Jersey Zinc Co., Palmerton, N. J., was recently elected president of the American Institute of Mining and Metallurgical Engineers and will take office February 20 at AIMME's Annual Meeting in St. Louis. Mr. Pierce is a past director and vice-president of AIMME.

John A. Moreland, Jr., formerly with Waddell Equipment Co., has been appointed manager of automotive castings sales for Hunt-Spiller Mfg. Corp., Boston. An Air Force officer in World War II, Mr. Moreland attended Massachusetts Institute of Technology and Columbia University. He succeeds **Gordon L. Leach.**

Sherman B. Burke, Boston, has been named Buffalo (N. Y.) district sales manager for Hanna Furnace Corp. Prior to his 15 years in the company's Boston office he had 12 years' experience in the company's Buffalo district. Pending appointment of a successor for the Boston office, he will continue its supervision.

H. Bornstein, head of the Materials Engineering Department, Deere & Co., Moline, Ill., and a Past National President of A.F.S., has been named chief technical consultant for the company. In his new position, Mr. Bornstein will plan the company's future technical developments and, in order to do this, has separated himself from the Materials Engineering Department. Succeeding Mr. Bornstein as manager of that department will be **F. T. McGuire,** who has been assistant manager of the department since July 1, 1949.

H. Bornstein

Thaddeus Giszczak, for the past three years research metallurgist for the A.F.S. Cupola Research Committee, is now metallurgist with the Central Foundry Div., General Motors Corp., Saginaw, Mich. A graduate of Wayne University, Detroit, he worked for several companies in Michigan and was for a year and a half assistant professor at Wayne prior to his cupola research work. He has written a number of articles on cupola operation for AMERICAN FOUNDRYMAN and participated in the revision of the A.F.S. HANDBOOK OF CUPOLA OPERATION which is now going on.

Sverre Gahr of Jotul & Kvaerner Foundry, Norway, who is a graduate in administrative engineering of Syracuse University and has been working in the iron foundry of Crouse-Hinds Co., Syracuse, was a recent visitor to the A.F.S. National Office while in Chicago on a tour of U. S. iron foundries. Mr. Gahr will apply his knowledge of U. S. foundry methods as an executive of Jotul & Kvaerner, Norway's largest iron foundry.

Carl H. Hecker, vice-president in charge of manufacturing, Oliver Corp., Chicago, has been named to the Board of Directors of the Chicago Farm and Industrial

Equipment Manufacturers Association. Mr. Hecker, who joined the company as general manager of its South Bend plant in 1946 became vice-president in 1949.

OBITUARIES

Noah H. Jacobsen, 68, president of Western Chemicals Co., Chicago, died of a heart attack at his home in that city on November 20. A native of Niantic, Ill., Mr. Jacobsen graduated from the University of Illinois in 1906 and established Western Materials Co. in 1918. He had been an active member of the A.F.S. Chicago Chapter for many years.

William L. Bond, 58, managing director of Bond Brass, Ltd., Eastview, Ont., Canada, and a charter member and past director of the A.F.S. Eastern Canada Chapter, died in Ottawa, Ont., November 19. Mr. Bond was manager and superintendent of Ottawa Car & Foundry Co. for 33 years prior to forming his own organization three years ago.

Julius S. Holl, 64, for almost 40 years advertising manager of Link-Belt Co., Chicago, died October 24 in Presbyterian Hospital, Chicago. Mr. Holl joined a Link-Belt subsidiary, J. M. Dodge Co., Philadelphia, as a clerk in 1905. He joined Link-Belt advertising department in 1911, was made advertising manager shortly afterwards in Philadelphia and ordered to move the department to Chicago. Mr. Holl was a past president of the Engineering Advertisers Association of Chicago and recently served as president of the National Industrial Advertisers Association.

Ernest V. Moncrieff, 60, retired president of Swan-Finch Oil Corp., New York, died November 5. Mr. Moncrieff had been with Swan-Finch for 35 years and served as president of that organization from 1930 to 1948. At the time of his death, Mr. Moncrieff was treasurer of the National Lubricating Grease Institute and served at one time as president of that organization.

George H. Zirker, metallurgist, Burndy Engineering Co., New York, died December 5. Born in Germany, Dr. Zirker was a graduate of Zurich University (Switzerland) and Aachen University (Germany). He is credited with being a co-discoverer of the proponents of titanium. He had served as metallurgist and chief metallurgist in several well-known foundry firms in the United States, Great Britain, Germany and Switzerland and with Armour Research Foundation, Chicago, prior to joining Burndy Engineering.

William Carver, 59, vice-president and assistant general manager of Auto Specialties Mfg. Co., St. Joseph, Mich., died in November at his home in that city. He was the company's first employee, hired as a stenographer when the firm was founded in Chicago in 1909. Active in St. Joseph civic affairs Mr. Carver served as a city alderman and was a former director of that city's Chamber of Commerce.

A. F. S. CHAPTER DIRECTORY

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NORTHWESTERN PENNSYLVANIA CHAPTER *Secretary,* Earl Strick, Erie Malleable Iron Co., Erie, Pa.
ONTARIO CHAPTER *Secretary-Treasurer,* G. L. White, Westman Publications, Ltd., 137 Wellington St. W., Toronto, Ont., Canada.
OREGON CHAPTER *Secretary-Treasurer,* William M. Halverson, Electric Steel Foundry Co., 2141 N.W. 25th, Portland, Ore.
PHILADELPHIA CHAPTER *Secretary-Treasurer,* W. B. Coleman, W. B. Coleman & Co., 9th and Rising Sun Ave., Philadelphia.
QUAD CITY CHAPTER *Secretary-Treasurer,* R. E. Miller, 4115 7th Ave., Moline, Ill.
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ST. LOUIS DISTRICT CHAPTER *Secretary,* Paul E. Retzlaff, Busch-Sulzer Bros. Diesel Engine Co., Div. Nordberg Mfg. Co., 3300 S. Second St., St. Louis 18.
SOUTHERN CALIFORNIA CHAPTER *Secretary,* Harold G. Pagenkopp, Angelus Pattern Works, 2084 Belgrave Ave., Huntington Pk., California.
TENNESSEE CHAPTER *Secretary-Treasurer,* Herman Bohr, Jr., Robbins & Bohr, Chattanooga Bank, Chattanooga, Tenn.
TEXAS CHAPTER *Secretary,* John M. Morris, Lone Star Steel Co., P. O. Box 8087, Dallas 5, Texas.
TIMBERLINE CHAPTER *Secretary,* James Schmuck, Rotary Steel Castings Co., 1425—5th St., Denver, Colorado.
TOLEDO CHAPTER *Secretary-Treasurer,* R. C. Van Hellen, Unitcast Corp., 1414 E. Broadway, Toledo, Ohio.
TRI-STATE CHAPTER *Secretary,* C. C. Beagle, Webb Corp., Box 549, Webb City, Mo.
TWIN-CITY CHAPTER *Secretary-Treasurer,* Lillian K. Polzin, Minneapolis Chamber of Commerce, 1750 Hennepin at Groveland Terrace, Minneapolis.
WASHINGTON CHAPTER *Secretary,* F. R. Young, E. A. Wilcox Co., 517 Arctic Bldg., Seattle 4, Wash.
WESTERN MICHIGAN CHAPTER *Secretary,* Lauren Ramsey, Paul M. Weiner Foundry Co., Box 216, Muskegon, Mich.
WESTERN NEW YORK CHAPTER *Secretary,* R. E. Walsh, Hickman, Williams & Co., 32 Eastwood Place, Buffalo, N. Y.
WISCONSIN CHAPTER *Secretary,* J. G. Risney, Risney Foundry Equip. Co., 1307 N. 63rd St., Milwaukee 13.

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STUDENT CHAPTERS

MIT *Secretary-Treasurer,* Charles R. Herbert
UNIVERSITY OF ILLINOIS *Secretary,* Eugene Keith Van Ness
MICHIGAN STATE COLLEGE *Secretary-Treasurer,* William Dieters
UNIVERSITY OF MINNESOTA *Secretary-Treasurer,* Gerald A. Sporre
MISSOURI SCHOOL OF MINES *Secretary,* Ralph E. Johnston
OHIO STATE UNIVERSITY *Secretary-Treasury,* Edward H. Losely
OREGON STATE COLLEGE *Secretary,* Leonard M. Preston
TEXAS A & M COLLEGE *Secretary,* R. L. Jones
UNIVERSITY OF ALABAMA

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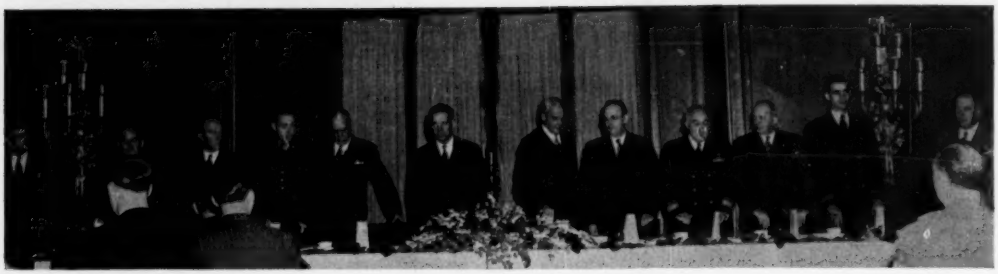


Army and Navy officials, A.F.S. National and Chapter officers and directors occupied the speakers' table at Philadelphia Chapter's Management Dinner on November 21 at Philadelphia's Union League Club.

CHAPTER ACTIVITIES NEWS

Missouri School of Mines

Norbert F. Neumann
Chapter Reporter-Photographer

NOVEMBER 24 meeting featured a talk by Marshall Petty, Key Co., East St. Louis, Ill., on *"Acid Electric Furnace Practice."*

Mr. Petty discussed an electric furnace heat from meltdown to tapping. Gaseous oxygen is used as an oxidizing reagent at the Key Co. and it was pointed out that 15 minutes are saved per heat with this method over ore practice. Mr. Petty also stated that since no two heats are alike, laboratory control is essential. This is particularly true today when specifications are becoming more rigid.

Guests from St. Louis were: J. H. Williamson, M. A. Bell Co.; Jack Bodine, Bodine Foundry; Steve Ban and Joseph MacVey, National Bearing Div. American Brake Shoe Co.; and Ralph Johnson of the M. W. Warren Coke Company.

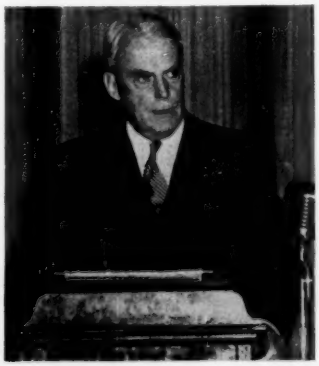
Northwestern Pennsylvania

Earl M. Strick
Erie Malleable Iron Co.
Chapter Reporter

NOVEMBER 27 MEETING featured a discussion of *"Some Problems in Bronze Castings,"* by R. A. Colton, Federated Metals Division, American Smelting & Refining Co.

Mr. Colton went into detail on manufacture of various alloyed metals of the bronze family and theorized on the causes of such casting defects as shrinks and blow holes. Vice-Chairman Douglas James presided at the meeting in the absence of Chairman Frank Volgstadt, who was ill.

November 10 meeting had two speakers. George F. Watson, American Brake Shoe Co., Mahwah, N. J., described work of the A.F.S. Sand Control Committee on molding and core sands. J. Murdock Dawley, president of the New York State Teachers College, spoke on *"The United Nations and You,"* in which he stated that regardless of many reverses suffered by peace-loving nations, the UN has settled many problems that would otherwise have resulted in crises equal to that in Korea. It may take years, the speaker said, to achieve unity of nations through the UN but this will eventually come about.



Featured speaker at Philadelphia Chapter's Management Dinner, held November 21 at the Union League Club, Philadelphia, was Gen. Donald Armstrong, U. S. Pipe & Foundry Co., Burlington, N. J.

Philadelphia

G. H. Bradshaw
Philadelphia Naval Shipyard
Chapter Vice-Chairman

THIRD MANAGEMENT MEETING staged by the Philadelphia Chapter took place at the Union League, Philadelphia, November 21. Once again, as at the previous two management meetings, over 100 representatives of top foundry management turned out to hear Gen. Donald Armstrong, president of United States Pipe & Foundry Co., Burlington, N. J., speak on *"Company Planning for Industrial Mobilization."*

Chapter Chairman Clyde B. Jenni, General Steel Casting Co., presided. Harvey Johnston of the same company acted as toastmaster. In his introduction, Mr. Johnston stated that the best way to improve production is by application of the latest technological developments through free interchange of ideas.

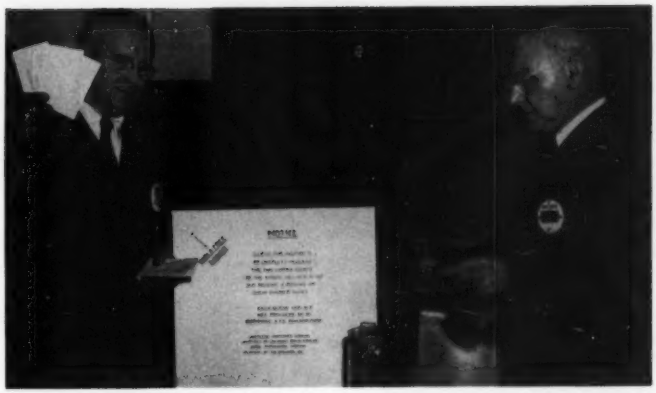
Gen. Armstrong, formerly Chief of the Chicago Ordnance District and head of the Army Industrial College, spoke about the tremendously increased recognition which the ordnance services now have for foundry products as compared with the period prior to World War II. He stated that since

war today is primarily a conflict of industrial systems, a company organization must be sound to be effective in war production and that plant morale must be raised and maintained at a high level. Gen. Armstrong complimented the industry on the formation of an Advisory Committee to the Munitions Board and urged fullest industrial cooperation to the end of bringing government specifications to an industrial basis.

Preceding Gen. Armstrong, A.F.S. President Walton L. Woody spoke of the value of technical cooperation through the medium of societies such as A.F.S. He declared that while it is difficult to gage the progress of an industry from year to year, practically every phase of foundry practice has been materially advanced during the past 25 years, largely through the cooperative and free exchange of information. "Europeans come to this country," he stated, "Because they do not have there such a free exchange of ideas and experience." He added that we many expect to receive considerable information on overseas foundry practices at the International Foundry Congress to be held by A.F.S. in Atlantic City, N. J., in May, 1952.

Those at the speakers' table included A.F.S. Director E. C. Troy, Palmyra, N. J.; Philadelphia Chapter Vice-Chairman G. H. Bradshaw, Philadelphia Naval Shipyard; Chapter Secretary-Treasurer W. B. Coleman, W. B. Coleman & Co.; Rear Admiral Ricco Botta, commander of the Naval Air Materials Center, Philadelphia; Col. W. K. Ghormley, Deputy Chief of Philadelphia Ordnance District; Capt. L. A. Kniskern, commander of Philadelphia Naval Shipyard, and A.F.S. Secretary-Treasurer Wm. W. Maloney, Chicago. The invocation was given by Lt. Nerthling, U. S. N., Chaplain of the Philadelphia Naval Base.

C. R. Tinsley of U. S. Pipe & Foundry Co. and director of the Philadelphia



Huckstering tickets for a "guess the number of chaplets in the bottle" contest at Detroit Chapter's November 16 meeting was Richard F. Lang, Richard F. Lang Co. (left). Prospective buyer at right is William Winter, King Seeley Corp. Two winning guessers received refunds on dinner tickets. Proceeds of contest were donated to A. F. S. Building Fund.

More than 200 foundrymen attended the first session of Chicago Chapter's Sand School, conducted at the University of Illinois, Navy Pier Branch, Chicago, November 27-30, by F. S. Brewster, Harry W. Dietert Co., Detroit.

Occupying the speakers' table at Wisconsin Chapter's October Management Meeting were, left to right: Past Chapter President Robert C. Woodward, Bucyrus-Erie Co.; Speaker William J. Grede, Grede Foundries, Inc.; Chapter President W. W. Edens, Badger Brass & Aluminum Foundry; Vice-President George E. Tisdale, Zenith Foundry Co.; C. S. Anderson, Belle City Malleable Iron Co.; R. W. Osborne, Lakeside Malleable Casting Co.; J. E. Schaible, Crucible Steel Casting Co., and C. W. Schwenn, Brillion Iron Works. (Wisconsin Chapter photographs provided through courtesy of Walter V. Napp, Badger Fire Brick & Supply Co.)

Looking over membership rosters of Northern California Chapter at a Chapter Board of Directors meeting October 27 are, left to right: Director Don C. Caudron, Pacific Brass Foundry; A.F.S. National Secretary-Treasurer Wm. W. Maloney; Chapter Secretary Davis Taylor, American Wheelabrator & Equipment Co.; Treasurer Fred Mainzer, Pacific Brass Foundry; and Chapter Director-Publicity Chairman J. M. Snyder, Jos Musto Sons-Keenan Co. (Photo courtesy Sam Russell, Phoenix Iron Works).

Chapter, who shortly will head a new pipe foundry for his company at Dakota, Calif., was presented with a traveling bag as a token of esteem.

The Committee on Arrangements for the meeting was headed by W. A. Morley, Link-Belt Co. Members of his Committee included, in addition to Messrs. Bradshaw, Jenni, Troy and Tinsley, the following: B. A. Miller, Baldwin Locomotive Works; W. D. Bryden, Philadelphia Bronze & Brass Corp.; R. J. Keeley, Ajax Metal Div., H. Kramer Co.; H. E. Mandel, Pennsylvania Foundry Supply & Sand Co.

November 10 meeting had an attendance of about 150 members and their guests. Preceding the technical meeting, Dr. Stanley P. Reiman, director of Lankenau Hospital Institute and the Institute for Cancer Research spoke.

Speaker of the evening was Earl E. Woodliff, Detroit foundry sand consultant, who covered various phases of sand control, doing an excellent job in describing the uses of sand and binders. Technical chairman for the meeting was H. J. Williams, New Jersey Silica Sand Co.

Detroit

R. Grant Whitehead
Claude B. Schneible Co.
Chapter Reporter

"PAST CHAIRMAN'S NIGHT" was the designation of the November meeting, held at the Leland Hotel, Detroit.

Fred Walls, International Nickel Co., Detroit, Past National President of A.F.S. and Past Detroit Chapter Chairman, outlined the history of A.F.S. from 1896 to date and introduced other past chairmen present.

Featured event of the evening was a showing of the new A.F.S. Research Film, *"Fluid Flow in Transparent Molds—II,"* with Dr. Robert F. Thomson, General Motors Research Institute, chairman of the A.F.S. Aluminum & Magnesium Division, sponsor of the film, as commentator.

In token of appreciation for bringing the chapter this excellent film, Dr. Thomson was presented with a set of Detroit Chapter book ends by Vice-Chairman Vaughan C. Reid, City Pattern Foundry & Machine Co.

Eastern Canada

M. G. McQuiggan
Canadian Foundry Supply & Equipment, Ltd.
Chapter Reporter

"PROBLEM CASTING FORUM" was featured at the Chapter's November 17 meeting, held at the New Sherbrooke Hotel, Sherbrooke, Que., Canada. In this, a panel of foundry experts looked over a casting blueprint and decided the most efficient and economical way to produce not only the casting, but the pattern.

Chapter Chairman Lucien Guilmette, Canadian Foundry Supplies & Equipment, Ltd., conducted the general meeting, while W. Turney Shute, Canadian Car & Foundry Co., conducted the forum.

Assisting Mr. Shute as foundry experts on the panel were: Leonard Bradley, Canadian Ingersoll-Rand Co., Ltd.; Wilfrid Legare, La Fonderie Legare; James H. Clark, Canada Iron Foundries, Ltd.; Henri Louette, Warden-King, Ltd.; James Grieve, Dominion Engineering Works, Ltd.; and William Birks, Crane, Ltd. Edward Laurendeau, Canadian Pattern & Woodworking Co., prepared a sample corebox and pattern, and Mr. Louette

(Left) Hardest working man at Timberline Chapter's November 13 meeting was Chapter Treasurer Thomas W. Widener, American Manganese Steel Div., American Brake Shoe Co., Denver. (Right) Snapped at the meeting were Chapter Chairman John W. Horner, Jr.; Slack-Horner Brass Co., Director Jerry Lahr, Aluminum Co. of Denver, and Chapter Secretary James E. Schmuck, Rotary Steel Casting Co., all of Denver.

Speakers' table occupants at Western New York Chapter's December 1 meeting were, left to right: Chapter Directors A. J. Heysel and G. A. Knowles, J. E. Woodison, A.F.S. National Director L. D. Wright, Vice-Chairman Erwin Deutschlander; Speaker J. M. Clifford, Bison Castings, Inc., Buffalo; R. K. Glass and Chapter Chairman A. A. Diebold. (Photograph courtesy Marve Taublieb, Frederic B. Stevens, Inc.)

made castings from these patterns, which were exhibited at the Sherbrooke meeting.

About 70 A.F.S. members arrived from out-of-town points. Deputy Minister Mark Boyer of the Canadian Department of Mines and Technical Surveys was represented at the meeting by Chief Engineer Norman McPhee, Department of Mines Experimental Laboratories, and by H. Tardiff of the Department of Mines. Membership Chairman A. J. Moore, Montreal Bronze, Ltd., introduced some 14 members, nine of them from the Sherbrooke area. This was the first occasion on which the Chapter's monthly meeting was held outside Montreal.

Timberline

J. W. Horner
Slack-Horner Brass Foundry Co.
Chapter Chairman

ANNUAL CHRISTMAS PARTY, held at the Oxford Hotel, Denver, December 11, was attended by 45 members and guests. Features of the party were excellent amateur entertainment and awarding of some 25 prizes donated by various Denver firms and by members of the chapter. Chapter Director Warren Prosser, Federated Metals Division, American Smelting and Refining Co., was chairman of the Entertainment Committee for the event.

St. Louis District

N. L. Peukert
Carondelet Foundry Co.
Publicity Chairman

NOVEMBER 9 MEETING had as its featured speaker Harry W. Dietert, Harry W. Dietert Co., Detroit, who discussed *"Sand Control and its Relationship to Casting Quality."*

The speaker prefaced his talk by describing great advancements made in sand control and said that the time is not too far in the future when sand control may be an exact science. Mr. Dietert stated that no one test will suffice in sand control and listed five

Vice-Chairman Vaughan C. Reid, City Pattern Foundry and Machine Co., Detroit (left), gets a preview of the new sound-color A.F.S. Research Film, "Fluid Flow in Transparent Molds– II" from Dr. Robert F. Thomson, General Motors Research Institute, before Detroit's November 16 meeting.

Harry W. Dietert, Harry W. Dietert Co., Detroit, speaking on "Sand Control and Its Relationship to Casting Quality" at the November 9 meeting of the St. Louis District Chapter, held at the York Hotel, St. Louis.

Feminine charm in the person of Gail Adair assisted in drawing the winning ticket at Southern California Chapter's recent television set raffle for the benefit of the A.F.S. Housing Project. Assisting Miss Adair is Earl Appleman, Calmo Engineering Co. (Photo: Ken Sheckler of Calmo).

Technical Chairman H. J. Williams, New Jersey Silica Sand Co. (left), looks on as Speaker Earl E. Woodliff, Detroit foundry sand consultant, answers questions from the floor at Philadelphia's November 10 meeting.

basic characteristics of sand as a molding product:

1. Green Properties: these properties may be determined in part by permeability tests, green compression strength, green deformation, and fineness tests, which also determine sand clay content.
2. Air Set: partial drying of sand after mold is made and before pouring.
3. Dry Strength: manner in which sand reacts while oven drying or when molten metal is poured into the cavity.
4. Hot Properties: reaction of sand after pouring-expansion and contraction characteristics.
5. Retained Properties: action of sand during and after shake out and its response to reclamation.

Mr. Dietert's talk dealt mostly with green properties and importance of green deformation in determining molding properties. The speaker also stressed the use of a quick fineness test using the standard hydrometer method, which he prefers over the screen analysis, to determine "fines" in the sand. "Fines" (0-50 micron particles) should be less than 10 per cent for the control of scabs, the speaker pointed out. Limits on sand test results have changed, he added, citing as an example that several years ago 7.5 lb green compression strength was considered ample for gray iron molding, whereas today 15 and 18 lb green compression is not uncommon.

Western New York

Marve Taublieb
Frederic B. Stevens, Inc.
Publicity Chairman

DECEMBER 1 MEETING featured Joseph M. Clifford, Bison Castings, Inc., Buffalo, speaking on *"Nodular Iron."*

Mr. Clifford's talk began with presentation of slides showing various types of castings poured in nodular

Foundry experts leading discussion at Eastern Canada Chapter's Problem Casting Forum, a feature of the November 17 meeting, were, left to right: Leonard Bradley, Canadian Ingersoll-Rand Co.; Wilfrid Legare, La Fonderie Legare; James Clark, Canada Iron Foundries; James Grieve, Dominion Engineering Works, Ltd.; Vice-Chairman W. Turney Shute, Canadian Car & Foundry Co.; Henri Louette, Warden King, Ltd.; William Birks, Crane, Ltd.; Chairman Lucien Guilmette, Canadian Foundry Supplies & Equipment.

iron for pressure and machine work and illustrating types of gating and risering and sand used. Hardness-tested specimens from 4 and 5 in. sections were also shown to illustrate uniformity of nodular iron heavy areas, indicating its suitability for pressure work.

Slides depicting effects of the action of magnesium on base metal treated, and final silicon inoculation with reference to structure in the cast condition were also presented. Included were slides of the above in annealed condition.

The speaker emphasized the importance of base and final chemical compositions and the necessity for metal temperatures of 2800 to 2900 F at time of tap.

Mr. Clifford presented reproduceability graphs showing consistency from heat-to-ladle and ladle-to-ladle as related to chemical composition and physical properties and graphs of chemicals and physicals of medium carbons 3.50 to 3.60 per cent and higher levels of 3.75 to 3.90 per cent carbon nodular heats as cast. Also displayed by Mr. Clifford were castings and test bars.

Robert K. Glass, Republic Steel Corp., Buffalo, meeting technical chairman, outlined the history of the gray iron industry, pointing out in conclusion that some 70 foundries in the United States and 30 in Europe are producing nodular iron in cupolas and that Bison Castings, Inc., Buffalo, is believed to be the only foundry producing nodular iron in an electric furnace.

Notable among meeting guests were Ronald C. Timins, Welland Iron & Brass, Ltd., Welland, Ont., Canada; Max T. Ganzauge, General Railway Signal Co., Rochester, James Ochsner, Edward Feisinger, Jr., and J. J. Livingston, Crouse-Hinds Co., Syracuse.

Ohio State University

William M. Harper
Publicity Chairman

NOVEMBER 14 MEETING had as its guests Frank H. Bonnet, Buckeye Steel Casting Co., Columbus; H. S. Hessey, C. O. Bartlett & Snow Co., Cleveland, and Joseph Bailey, GHR Div., Dayton Malleable Iron Co., Dayton.

Following a business meeting, G. K. Dreher, executive director, Foundry Educational Foundation, Cleveland, presented a talk entitled *"Let's Be Practical,"* in which he discussed some problems in human relations that will confront the young engineer when he achieves management status.

Members and guests were given a paper listing desirable qualities that employers look for when hiring college engineering graduates.

Occupying the head table at Eastern New York Chapter's November 21 meeting were, left to right: Membership Chairman Edward Lawrence, Director Alexander C. Andrew (face hidden), Secretary-Treasurer Leigh Townley, Chapter Program Chairman John Waugh, Speaker of the Evening Harry M. St. John, Crane Co., Chicago, and Chapter Director Lyman Thunfors.

Sparking the November 24 meeting of the Missouri School of Mines Student Chapter were, left to right: Sam Smart, Speaker Marshall Petty of the Key Co., East St. Louis, Ill., Students Roger Burns and Joseph March.

Cincinnati District

John F. Kahles
University of Cincinnati
Chapter Reporter

ALMOST 100 MEMBERS and guests attended the November 13 meeting, which featured Robert P. Schauss, Illinois Clay Products Co., Chicago, speaking on *"Sand Properties and Casting Defects,"* in which he informally discussed typical castings defects and ways of remedying them. He placed particular emphasis on the trend toward higher mold hardness in order to achieve better sand-metal properties.

A surprise feature of the meeting was the showing of the film *"Fluid Flow in Transparent Molds,"* Part II, prepared by A.F.S. Aluminum-Magnesium Committee and Battelle Memorial Institute. The film was explained in detail by Walter Klayer, Past chairman of the Cincinnati District chapter, and received such an enthusiastic reception that plans were immediately formulated for additional showings as soon as convenient.

Rochester

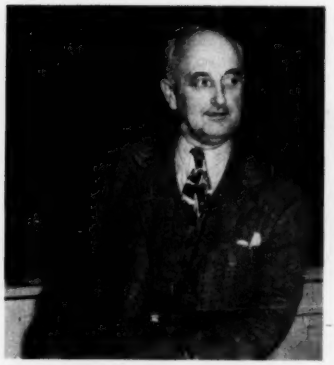
Donald E. Webster
American Laundry Machine Co.
Chapter Reporter

DECEMBER MEETING, held at the Hotel Seneca, Rochester, featured a talk by R. A. Colton, American Smelting & Refining Co., on *"Some Problem Non-Ferrous Castings."*

Copper has a high solubility for both oxygen and hydrogen and this gives rise to many problems in the melting and casting of these important alloys, Mr. Colton said. These gases come from the decomposition of water derived from atmospheric moisture, from the mold or from the fuel employed. Mr. Colton discussed various methods

now in use to minimize gases in castings, such as control of pouring temperatures, addition of metallic zinc, use of a layer of charcoal over molten metal, and flushing with nitrogen. Effects of several metals on the conductivity of copper were considered.

High-lead alloys for bushings also have peculiar characteristics, as do aluminum-magnesium alloys, and considerable time and effort have been devoted to study of gating and feeding and directional cooling, the speaker said. Although Mr. Colton's remarks had to do primarily with non-ferrous alloys, he described good foundry practice equally applicable to cast iron metallurgy.



Associate Dean F. W. Trezise, head of Undergraduate Division Engineering Science Department, University of Illinois, Navy Pier Branch, Chicago, welcomes foundrymen to the Chicago Chapter's Sand School, held evenings November 20 to 24.

Chesapeake

Arthur A. Rauchfuss, Jr.
Penniman & Browne, Inc.
Chapter Reporter

OCTOBER 27 MEETING, held at the Engineers Club, Baltimore, opened with Chairman A. A. Hochrein, Federated Metals Div., American Smelting & Refining Co., discussing the current chapter membership drive and the A.F.S. Housing Project.

Feature of the evening was a round table discussion on general foundry practice, with Earl Bush, Washington Navy Yard, William Holtz, American Brake Shoe Co., and A.F.S. Past National President Edwin W. Horlebein, Gibson & Kirk Co., serving as members of the panel.

A wide range of problems were covered—types and preparation of molding sands, coreblowing, gating and risering sands, etc. Earl Gaffney, Ar-

FUTURE CHAPTER MEETINGS

● JANUARY 16
EASTERN NEW YORK
Circle Inn, Latham, N. Y.
Sound-color film: *"Fluid Flow in Transparent Molds—II"*

CHESAPEAKE
Engineers Club, Baltimore
J. A. GITZEN
Delta Oil Products Co.
"Do We Make GOOD Cores?"

● JANUARY 17
CENTRAL MICHIGAN
Legion Clubhouse, Battle Creek
KENNETH ROBINSON
Michigan Department of Health
"Dust Control"

● JANUARY 18
DETROIT
Leland Hotel, Detroit
"Quality Control by Statistical Methods"

● JANUARY 19
BIRMINGHAM DISTRICT
Tutwiler Hotel, Birmingham
R. A. FLINN
American Brake Shoe Co.
"Soundness and Feeding of Ductile and Gray Iron Castings"

TEXAS
Ft. Worth
Film and Panel Discussion: *"Men and Molds"*

WESTERN NEW YORK
Troop I Legion Post, Buffalo
ANNUAL STAG PARTY

NORTHERN CALIFORNIA
Hotel Shattuck, Berkeley
RUSSELL J. GEITMAN
Link-Belt Co.
"Mechanizing a Small Foundry"

● JANUARY 23
NORTHWESTERN PENNSYLVANIA
Moose Club, Erie
W. W. LEVI
Lynchburg Foundry Co.
"Cupola Practice"

● JANUARY 25
WASHINGTON
Gowman Hotel, Seattle
RUSSELL J. GEITMAN
Link-Belt Co.
"Mechanizing a Small Foundry"

● JANUARY 26
CHESAPEAKE
Engineers Club, Baltimore
J. A. GITZEN
Delta Oil Products Co.
"Do We Make GOOD Cores?"

● JANUARY 27
TENNESSEE
Nashville, Tenn.
S. C. MASSARI
A.F.S. Technical Director
Sound-color film: *"Fluid Flow in Transparent Molds—II"*

● FEBRUARY 1
CANTON DISTRICT
Mergus Restaurant, Canton, Ohio
PHILIP D. JOHNSON
Society for Non-Destructive Testing
"Use of Radium in the Foundry Industry"

● FEBRUARY 2
WESTERN NEW YORK
Sheraton Hotel, Buffalo
THOMAS E. BARLOW
Eastern Clay Products, Inc.
"Let's Kick It Around"

NORTHEASTERN OHIO
Tudor Arms Hotel, Cleveland
PATTERNMAKERS' NIGHT

● FEBRUARY 5
CENTRAL ILLINOIS
Legion Hall, Peoria
E. T. KINDT
Kindt-Collins Co.
"Latest Developments In Patternmaking Machinery and Tools"

Speakers table places of honor at a joint meeting of Western Michigan A.F.S. and ASM Chapters November 6 went to (starting left): Speaker Arthur Haagensen, Allis-Chalmers Mfg. Co., A.F.S. Chairman Stanley H. Davis, ASM Chairman Richard Fox, A.F.S. Secretary Fred De Hudy.

FUTURE CHAPTER MEETINGS

● **FEBRUARY 5 (Cont'd)**
METROPOLITAN
Essex House, Newark, N.J.
ROUND TABLE DISCUSSIONS

WESTERN MICHIGAN
Cottage Inn, Muskegon
HARRY E. GRAVLIN
Ford Motor Co.
"Sand, Metal or Men"

● **FEBRUARY 8**
ST. LOUIS DISTRICT
York Hotel, St. Louis
BERNARD N. AMES
New York Naval Shipyard
"Plastic Bonded Thin Shell Molds"

● **FEBRUARY 9**
PHILADELPHIA
Engineers Club, Philadelphia
MICHAEL BOCK, II
Exomet, Inc.
"Insulating Materials in Foundry"

NORTHWESTERN PENNSYLVANIA
New Castle, Pa.
Speaker to be announced

EASTERN CANADA
Mount Royal Hotel, Montreal
ROBERT HEROLD
Borden Co.
"Croning Casting Process"

● **FEBRUARY 12**
CINCINNATI DISTRICT
Engineers Club, Cincinnati
O. J. MYERS
Archer-Daniels-Midland Co. (The Werner G. Smith Co. Division)
"Cores"

CENTRAL OHIO
Chittenden Hotel, Columbus
R. P. SCHAUSS
Illinois Clay Products Co.
"Gating and Risering"

● **FEBRUARY 13**
TWIN CITY
Covered Wagon, Minneapolis
E. T. KINDT
Kindt-Collins Co.
"Pattern Engineering"

N. ILLINOIS-S. WISCONSIN
Faust Hotel, Rockford, Ill.
H. E. BALLINGER
Fanner Mfg. Co.
"Dielectric Baking of Cores"

● **FEBRUARY 15**
DETROIT
Rackham Memorial, Detroit
Casting Defect Night

● **FEBRUARY 16**
TRI-STATE
Tulsa, Okla.
Film: *"Fluid Flow in Transparent Molds —II"*

TEXAS
Texas State Hotel, Houston
ROUND TABLE DISCUSSIONS

NORTHERN CALIFORNIA
Hotel Shattuck, Berkeley
S. C. MASSARI
A.F.S. Technical Director
Sound-color film: *"Fluid Flow in Transparent Molds—II"*

● **FEBUARY 20**
EASTERN NEW YORK
Circle Inn, Latham, N. Y.
LYLE D. CLARK
"Cupola Operation"

● **FEBUARY 23**
CHESAPEAKE
Engineers Club, Baltimore
CLYDE A. SANDERS
American Colloid Co.
"Old Time Molder vs. Modern Operator"

Massachusetts Institute of Technology Student Chapter officers posed with Speaker D. J. Reese, International Nickel Co., New York, at the Chapter's November meeting. Left to right: Chapter Vice-President B. Alperin, President R. Neimela, Mr. Reese and Secretary E. Rapperport.

lington Bronze & Aluminum Co., brought in an example of a poorly made aluminum casting and several solutions were offered.

November 16 meeting began with a coffee talk by Charles Murphy, traffic engineer for the City of Baltimore, who discussed reasons behind recent traffic changes in that city.

Technical speaker of the evening was H. F. Bishop, Naval Research Laboratory, Washington, D. C., who gave an illustrated talk on *"Heat Transfer in Sand Molds."*

An item that should be of interest to Chesapeake area foundrymen is that Baltimore's new Vocational School will have a complete foundry course.

Thomas E. Barlow, Eastern Clay Products, Inc., Jackson, Ohio, speaking on "Fundamentals of Sand Practice" at the November meeting of Southern California Chapter. (Photograph courtesy Ken Scheckler, Calmo Engineering Co.)

Rochester

Donald E. Webster
American Laundry Machine Co.
Chapter Reporter

NOVEMBER 14 MEETING, held at Hotel Seneca, featured as its speaker Adam Mahonske, Semet-Solvay Div., Allied Chemical & Dye Co., who discussed *"Some Aspects of Cupola Operation."*

Development, during recent years, of higher strength irons, and their application in broader fields, has brought about a need for a better understanding of cupola melting. In addition, increased production throughout industry, with a corresponding shortage of highest quality cokes demands that details of cupola operation be given closer attention. To meet present-day specifications, and to produce hot clean metal consistently, Mr. Mahonske stressed several items of importance:

Patching material should be applied

Howard Wilder, Vanadium Corp. of America, Detroit, (in dark suit) answers some knotty questions following Tri-State's November 17 meeting.

to maintain a definite diameter day after day. Sand bottom should have sufficient slope to allow free and ready drainage of molten metal. Lighting of the bed coke should be standardized so as to give a uniformly hot fire, to assure complete heating of the refractories and bottom, and to produce uniformly hot metal from the start of the heat.

Mr. Mahonske advocates selection of coke size in proportion to cupola diameter, the size of coke splits to give a definite depth of coke between charges.

Use of some inferior coke for melting, and even the use of anthracite coal, brought out considerable discussion among the members and guests.

University of Minnesota

Gerald A. Sporre
Chapter Secretary

FIRST MEETING of the season for the student chapter was held November 8 in the Mechanical Engineering building. Speaker of the evening was O. J. Myers, Archer-Daniels-Midland Co. (The Werner G. Smith Division), who discussed the opportunities awaiting engineering college graduates in the foundry industry. Following Mr. Myers' interesting and inspirational talk and a question and answer session, the group adjourned to the foundry for a social hour with Twin City chapter members attending the meeting. "Foundry coffee" and doughnuts were served.

Second chapter meeting was held December 2, upon the occasion of installation of the school's new cupola. The event was interesting and exciting and both faculty and students are highly pleased with the cupola.

Birmingham District

J. P. McClendon
Stockham Valves & Fittings, Inc.
Publicity Chairman

OCTOBER AND NOVEMBER technical meetings proved to be most interesting and attracted more than 125 members and friends to each meeting.

In October, Thomas E. Barlow, Eastern Clay Products Inc., Jackson, Ohio, gave a most interesting discussion on *"Air Placement Process for Cupola Lining."* The forum period following the technical paper developed some interesting questions which were most satisfactorily answered.

In November, Frank W. Less, Durez Plastics & Chemicals, Inc., North Tonawanda, N.Y., spoke on *"The 'C' Process for Molds and Cores."* This proved to be a most interesting topic. Mr. Less is an authority on phenolic resins and their applications in industry.

The social hour preceding the dinner each month is under the direction of E. A. Brandler, chairman of the Entertainment Committee, and has proved to be a popular feature of the monthly meetings. Other members of the committee are William Bach, Gene Welchel and Lipscomb Carl.

Chairman Morris Hawkins presided over the dinners and technical sessions.

Vice-Chairman Charles K. Donoho, introduced the speakers and conducted the forum following each paper.

Plans are now being completed for the Nineteenth Annual Foundry Practice Conference to be held in Birmingham at the Tutwiler Hotel in February, 1951.

Northern California

Jay Snyder
Jos. Musto - Keenan Co.
Publicity Chairman

SECOND REGULAR MEETING of the year was held November 17, with Thomas E. Barlow, Eastern Clay Products, Inc., Jackson, Ohio, as speaker.

Mr. Barlow covered the matter of cupola lining very well, elaborating upon questions from the floor from time to time, relative to conditions that exist in some Northern California iron foundries. He also stressed that many foundries are not aware of the measurement of their coke beds, with the net result that they sometimes wonder why they are obtaining a relatively "cold" iron and not having it up to specifications. Numerous questions were shot at Mr. Barlow and he answered them all in a most efficient manner.

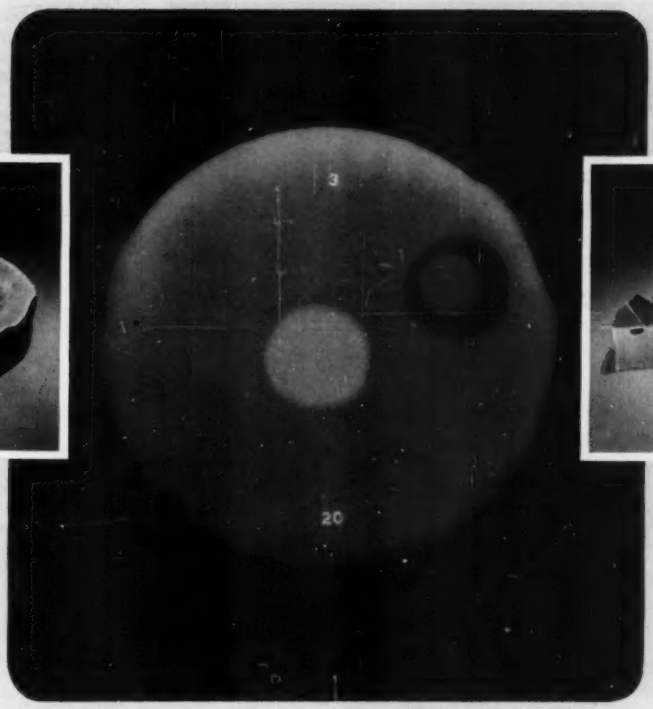
The chapter's perennial drawing winner, Weldon Russell, Phoenix Iron Works, won two tickets to the 49'er-Green Bay Packer football game on December 10.

Program Chairman Philip C. Rodger General Metals Corp., announced that the December meeting would be a "Father and Sons Night," along with the regularly scheduled program on *"Non-Destructive Testing"*.

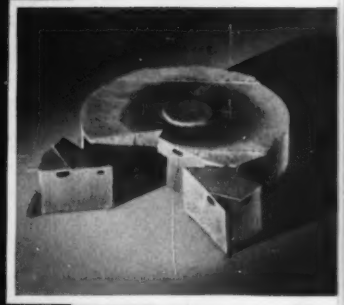
(Continued on Page 76)

A few of the Midwest foundrymen who found relaxation at Quad City Chapter's Xmas Party, December 8.

Aluminum alloy casting 2¼ x 11¾" for aircraft accessory part.



Radiograph which revealed defect in casting.



Section reveals hole detected by radiography.

Minutes of Radiography saved hours of machining

AFTER machining, this aluminum alloy casting was to be an important part in an aircraft accessory, vital to high-altitude flying. The finished part was needed quickly by the customer. Design specifications demanded high quality.

This was no time to wait for machining to disclose any defects. There was too much to lose —setup time, machining time, take-down time, as well as the reputation of the foundry.

Radiography saved all that. In a few minutes it revealed a defect that caused rejection of the rough casting at the foundry. Other castings, proved sound by radiography, were sent to the customer.

Cases like this show how more and more foundries are able to release only sound castings. Perhaps even more important, radiography is showing how to make consistently sound castings, by picturing the internal effects of changes in gating, venting, chilling, pouring temperature, and other variables.

Ask your x-ray dealer to explain how radiography can help you increase yield and cut costs.

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X-Ray Division, Rochester 4, New York

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There were many salesmen "working on" Brown, some of them promoting various types of melting equipment. Brown listened attentively to them all—heard their stories through. Always he came back with the same considered answer—"Twice I have been pulled off using Crucible melting; both times it has been costly to my foundry and to my pride.

Sure, I am still open to conviction; and maybe some day there will come up a method equal in some phases to Crucible melting. But as for equaling Crucible melting in all phases, as yet there 'ain't no such animal'."

Send for Crucible Melters' Handbook; mailed free.

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NEW YORK 6, N.Y.

CHAPTER ACTIVITIES

(Continued from Page 74)

Southern California

S. L. Jackson
Electro Metallurgical Div.,
Union Carbide & Carbon Corp.
Publicity Chairman

Anticipation of winning the television set raffled off for the benefit of the A.F.S. Housing Project drew a large crowd to the November meeting. Donated jointly by several foundries and supply houses, the television set was raffled off by Emil Pesche, Reliance Regulator Div., American Meter Co., Alhambra. The raffle, which raised well over $500 for the Housing Project, was won by Anthony Tuzzolino of Overton Foundry.

Guest speaker at the meeting was Thomas E. Barlow, Eastern Clay Products, Inc., Jackson, Ohio, whose subject was *"Fundamentals of Sand Practice."* Mr. Barlow emphasized proper and effective use of sand testing equipment and proper interpretation of test results for effective sand control.

In order to obtain sand having the same physical characteristics each day, control measures must begin in the core room, as sand distribution in the core room eventually becomes sand distribution in the mold room, Mr. Barlow stated.

Over long periods of time, the most satisfactory method of keeping sand conditions under control is by keeping curves on the properties of the sand, indicating green strength, dry strength, moisture content, permeability, distribution, etc. These curves will indicate the trend of the sand properties which may not be discernable by interpretation of any one day's tests. Good sand is controlled sand," Mr. Barlow said, concluding by describing four systems of synthetic bonding material and their application in molds for production of steel, iron and nonferrous castings.

Central Pennsylvania

R. W. Lindsay
Pennsylvania State College
Chapter Reporter

THIRD MEETING of the season, held December 6 in the Mineral Industries Building, Pennsylvania State College, had as its speaker Clyde A. Sanders, American Colloid Co., Chicago, who addressed the group on *"Effect of Certain Mold Materials in Mold and Core Sand Mixtures."* Mr. Sanders divided his talk into two parts, the first dealing with casting defects and the second with the effect of mold materials on metal shrinkage.

Mr. Sanders illustrated several common castings defects, such as shifts, metal penetration, scabs, drops, rat-

tails and buckles. Means for combating these and importance of proper sand distribution and other means of controlling sand expansion were discussed. Mr. Sanders feels that distribution over four or five adjacent screens gives the best results.

The speaker pointed out in the second part of his talk how bond, moisture and sand additives such as seacoal and wood flour tie in with metal shrinkage. The latter can be kept under control by regulating, or controlling, mold movement as the metal enters the cavity. Methods of increasing the thermal conductivity of portions of the mold so as to "set up" the metal fast were discussed. An interesting question and answer period followed the talk.

Chicago

I. H. Dennen
Beardsley & Piper Div., Pettibone Mulliken Corp.
Chapter Reporter

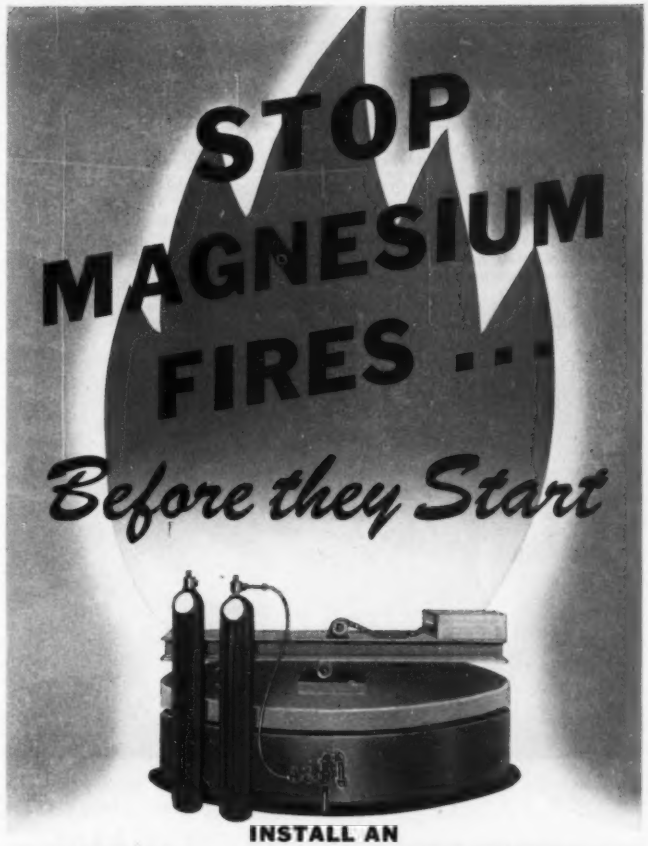
CAREFUL PLANNING and preparation contributed largely to the success of Chicago Chapter's Sand School. Prof. R. E. Kennedy, University of Illinois, A.F.S. Secretary Emeritus, and his committee deserve a large part of the credit for making the course available to Chicago foundrymen.

The course itself was presented by F. W. Brewster, Harry W. Dietert Co., Detroit, and covered basic principles of sand control and control equipment problems of molding and core sands, and problems in overcoming casting defects. Fifty-six Chicago area companies were represented at the course, which was given without charge since meeting facilities of the University of Illinois were made available to the chapter.

Sand Course Committee reports that 220 foundrymen registered for the Course and that the average attendance each night was over 180. Consensus of those who attended was that the course was well worth the time involved and it is hoped that the Chicago chapter will again be able to present the Sand School sometime in the near future.

December 4 meeting featured a showing of the A.F.S. Aluminum & Magnesium Division Research Film *"Fluid Flow in Transparent Molds—II,"* with A.F.S. Technical Director S. C. Massari introducing the film and pointing out that it supplements the fluid flow film presented last year. The new film is in color and is complete with sound track and is thus far more enlightening than last year's film.

The film was produced under direction of the A.F.S. Aluminum & Magnesium Division Research Committee at Battelle Memorial Institute, Colum-



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1. **An Ansul SO_2 system for mold flushing immediately before pouring, and**
2. **An Ansul manually controlled system to maintain a protective atmosphere in your heat treating ovens.**

The use of Ansul SO_2 systems eliminates the fire hazard by preventing oxidation, reaction and ignition of magnesium and its alloys during pouring and heat treating operations.

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HOW TO RECONDITION SAND ON THE FLOOR AFTER SHAKEOUT!

Get up to 50 *tons per hour* of *completely* conditioned sand with the new, improved Nite-Gang! It self propels, self loads, blends, magnetically separates, breaks lumps, thoroughly screens, double aerates and windrows or piles. The Nite-Gang increases molders' productivity and lowers molding costs!

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bus, Ohio, and is the result of three years' research. Although dealing primarily with flow of light metals, the film is also of great interest to ferrous foundrymen.

In his talk preceding showing of the film, Mr. Massari pointed out some of the difficulties encountered in production of the movie and told how high-speed camera techniques contributed to its clarity.

Twin City

O. J. Myers
Archer-Daniels Midland Co.
(The Werner G. Smith Co. Division)
Publicity Chairman

MORE THAN 80 Twin City foundrymen heard Harry W. Dietert, Harry W. Dietert Co., Detroit, speak on sand control at the November 14 meeting, held at the Covered Wagon, Minneapolis, Minn.

According to Mr. Dietert sand testing may be divided into six distinct categories—structural, green properties, air set, dry strength, hot strength and retained strength.

Trend in gray iron foundry practice is toward higher green strength to provide a more foolproof material for machine operators, Mr. Dietert said, adding that 20 psi green bond is common.

Yield point of a good molding sand, the speaker said, should be near the point of maximum deformation and the deformation range should be between 0.016 and 0.020 in. per inch. Casting defects such as shrinkage can be caused by too-high deformation sands, according to Mr. Dietert.

The speaker set up the following limits for a good, workable gray iron sand that can be made to produce quality castings at a rapid rate: Dry Compression—20 psi max; Mold Hardness—70-80; Air Set Strength—20-100 psi; Hot Deformation (1000 F)—0.008-0.012 in. per in.; Hot Strength (1000 F)—20-80 psi.

Hot expansion and retained strength should be low as possible, he ended.

Western Michigan

C. H. Cousineau
Carpenter Bros., Inc.
Publicity Chairman

A.F.S. WESTERN MICHIGAN CHAPTER was host to the ASM Western Michigan Chapter at its November 6 meeting, with 109 members and guests of both societies attending and enjoying a smorgasbord, followed by a roast turkey dinner.

Kenneth W. Haagensen, Allis-Chalmers Mfg. Co., Milwaukee, followed up a fine dinner with an outstanding talk on *"What Kind of a Salesman Are You?"*

Mr. Haagensen stated "we are a nation of negative propagandists," al-

ways emphasizing what is wrong with America. In contrast, he said, Russia gives us and the world nothing but "positive propaganda."

Evidences of negative propaganda heard all about us every day, according to Mr. Haagensen, are such statements as "prices are too high," "my job is no good," "we don't get enough pay," etc. The speaker was accorded a standing ovation.

An added attraction at the meeting was a showing of color movies of a "Capetown to Cairo" trip by A. E. Jacobson, Grand Haven Brass Foundry, who is one of about a hundred or so people who have made this trip through the heart of Africa.

Eastern New York

George E. Danner
American Locomotive Co.
Publicity Chairman

NOVEMBER 21 MEETING featured as guest speaker Harry M. St. John, Crane Co., Chicago, who discussed *"Brass and Bronze Foundry Practice."*

He pointed out how the success of a foundry of several years ago depended on the skill of the workers. Today, he said, it is more a matter of supervision, and type and maintenance of equipment. The modern trend includes temperature control equipment, casting design, and complete records as absolute necessities. Particularly stressed were all types of mechanical equipment, such as automatic molding, cleaning processes and sand control. Mr. St. John also discussed new molding trends, such as "shell molding" with thermosetting plastic. He emphasized that foundrymen should set a high goal which would eventually make available castings of any shape and strength to meet growing demands of industry.

MIT

Eugene J. Rapperport
Chapter Secretary

NOVEMBER MEETING was highlighted by an interesting talk given by D. J. Reese, International Nickel Co., New York, on the past, present and future of the foundry industry.

Mr. Reese pointed out that the foundry industry today is in a state of transition between an "art" and a "science." The industry is making progress, he said, but it would make more progress if the industry were to sell itself to the public. Competition to the foundry industry comes from other methods of fabrication, Mr. Reese said, and not from the foundry down the street.

Summarizing the importance of the foundry industry in the world's economy, Mr. Reese said that there is great opportunity in the industry for men of ability.

Newly-elected officers of the MIT Student Chapter for 1950-51 are: *president,* Ray W. Niemela; *vice-president,* Bernard Alperin; and *secretary,* Eugene Rapperport.

Central New York

James W. Ogden
Cleveland Tramrail Syracuse Co.
Publicity Chairman

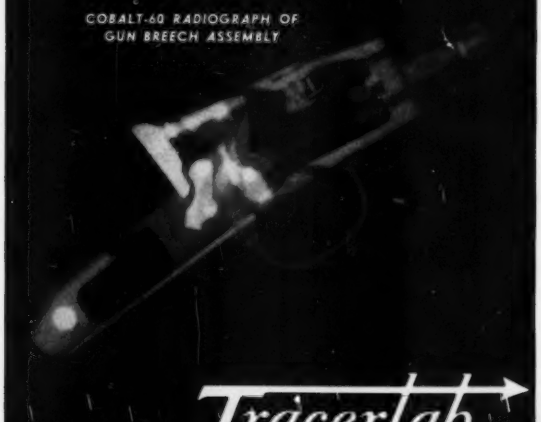
NOVEMBER MEETING was held at the Mark Twain Hotel, Elmira, November 10 and was attended by 85 members and guests, who enjoyed fellowship and an excellent dinner and talk.

Chairman David Dudgeon, Jr., held a short business meeting and introduced the speaker, Guy A. Pealer, Elmira Foundry Works, General Electric Co., whose topic was *"Pattern Engineering and Coordination of Methods to Produce Better Castings."*

Mr. Pealer pointed out that in designing pattern equipment for any foundry, molding methods of the foundry must be considered. He also recommended that both pattern and casting quotations to customers be based on whether a loose solid wood pattern, a split pattern or a match-

(Continued on Page 84)

COBALT-60 RADIOGRAPHY SOURCES



Cobalt-60 is now available at low cost in the form of high specific activity sealed sources especially designed for use in industrial radiography. Cobalt-60 radiographs are indistinguishable from those made with radium.

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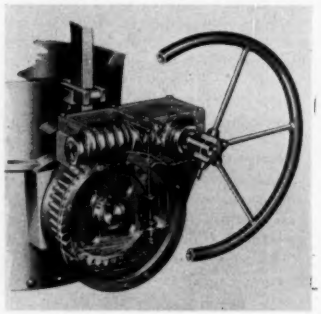
NEW Foundry Products

For additional information on New Products, use postcard on opposite page.

Geared Ladle

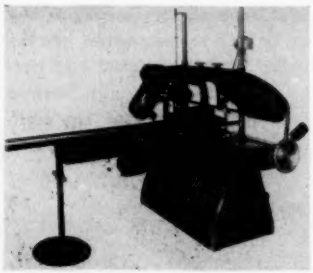
1—Model 592T ladle features new, completely adjustable worm and bevel gear that permits complete universal adjustability and eliminates gasket adjustments. All parts are easily accessible in this one-piece, self-contained unit that enables maintenance man to make quick



back-lash adjustments to pin-point accuracy and positive adjustment by adjusting bearing lock nuts on gears and worm. Unit is unaffected by heat, eliminating need for heat distortion clearance. Gearing is absolutely safe and positively self-locking. Available in all Industrial geared ladles, this new type of worm gearing can be supplied for Industrial geared ladles now in operation. *Industrial Equipment Co.*

Metal Cutting Band Saw

2—Designed to save operator fatigue, 14 in. Model D metal cutting band saw can be set automatically to raise itself at



completion of cut and start down again without stopping blade. Operator loosens vise, feeds stock in against stock stop and machine does the rest. Unit has 14 x 18 in. capacity, maximum clearance under saw blade of 20 in., 45 degree swivel vise in either direction, 14 ft, 5 in. x 1 in. x .035 in. blade size, and occupies 22 x 78 in. floor space. Features: blade guides with built-in shock absorbers, helical gear, full hydraulic control; rigidly-constructed tip-off guide; automatic stock stop; rotary blade brush; and quick acting vise on continuous screw. *W. F. Wells & Sons.*

Jolt-Squeeze Molding Machine

3—Rapid jolt squeeze molding machine features head that swings right or left and always parallel to bench plate, easily removable pistons and cylinders, plenty of

vertical adjustment, dust- and sand-free enclosed valves and hard-wearing steel frames. Model R9X is equipped with large jolt cylinder that gives it 30 per cent more jolt capacity than standard models and comes equipped with knee valves for operating jolt and vibrator. Special size bench plates, vibrator, air pressure regulator and air filter are optional. *Pioneer Mfg. Co.*

Floor Resurfacer

4—Designed for use where floors are subject to unusually rough usage and to corrosive or abrasive materials, Armor floor resurfacer bonds perfectly to old concrete floors and can be laid as thin as ½ in. over present bases. Resurfacer will not shrink or break its bond, sets up overnight and can be used within 24 hr or less if necessary. *Monroe Co.*

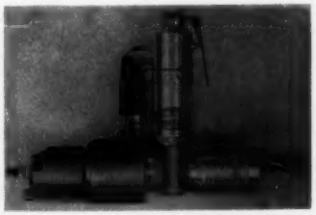
Sand Washer

5—Gordon-Campbell Sand Washer employs a centrifugal unit to remove clay from sand grain for determination of clay content of foundry sands, as recommended by the A.F.S. Committee on Foundry Sand Research. Single-blade impeller throws sand grains against baffles suspended in beaker containing sand and water. Motor is attached by bracket to rod which slides vertically in column. Syphon with inlet exactly 1-in. from bottom of beaker removes wash water from beaker. Syphon

action is started by compressing rubber bulb then closing outlet end of tube with one finger and releasing bulb. Sand Washer is available in two models—a single-unit washer with one graduated pyrex beaker, and a six-unit washer with six beakers. Both models can be used for other laboratory washing applications. *Claud S. Gordon Co.*

Automatic Countersink

6—Portable air-powered countersinking tool supplies own thrusting action and has



self-locking grip that holds tool firmly to work sheet while operating. Almost completely automatic in operation, tool requires no manual effort other than inserting mandrel in hole. Unit is available in

capacities ranging from ¼ in. to 1-¼ in. across mouth and countersinks holes ⅜ in. diameter and larger. Automatic operation assures perfect concentricity between hole and countersinking cut. *Buckeye Tools Corp.*

Utility Grinder

7—Utility Grinder features dynamically balanced rotors, integrally cast wheel guards, adjustable tool rests, fast-grinding, long-wearing abrasive wheels, heavy duty toggle switch, cast iron base with rubber mounting and rubber-covered cable with unbreakable plug. Fast starting, unit has ¼ hp, 3450 rpm dustproof motor operating single-phase, a-c, 60-cycle, 115 or 230 volt. Six-in. Model A grinder is also available for 2 or 3 phase, a-c, 60-cycle, 220 or 440 volt operation. Unit has prelubricated sealed ball bearings; 6-in. diameter x ¾-in. face wheels (one coarse and one fine grit) and is available in standard red or machine tool gray. *Lima Electric Motor Co.*

Electrical Industrial Truck

8—Completely redesigned, the Transporter 101 is a foot shorter than its predecessor, the Transporter. The 101 has a completely cast drive housing for full protection of operating parts and battery is guarded by cast-steel enclosure. Available in 4,000 or 6,000-lb capacities in pallet or platform types, Transporter 101 meets reduced aisle requirements and permits handling of longer loads; has lower center of gravity; operates in either forward or reverse speeds with handle upright; starts smoothly; has more efficient lifting and driving units, better brakes and larger tires. Finger-touch lever eliminates application of excessive leverage by the operator. *Automatic Transportation Co.*

Lathe

9—Popularly priced, 10 in. quick change gear lathe, the Light Ten, features high-strength iron-steel bed; hand-scraped V-ways, flat way and back-geared headstock to insure precision alignment of the spindle; wrenchless bull gear lock; improved spring latch feed reverse lever; and fully-enclosed machine-cut gears. Sleeve bearings prevent chatter marks due to vibration and large oil reservoirs and capillary oil system provide complete film of clean filtered oil for rotating spindle. Compound rest is graduated to 180 degrees, swivels to any angle and has improved locking device. Compound rest screw and cross-feed screw have micrometer collars graduated to read in thousandths of an inch. Two types of horizontal drive units are available: (1) a 12-speed (48 to 1435 rpm) drive using flat leather belt to headstock and (2) 16-speed (52 to 1365 rpm) drive with V-belt to headstock. *South Bend Lathe Works.*

Protective Masks

10—G-S Protective Masks consist of aluminum shield held in place by adjustable elastic headband and replaceable laminated filters of extra thickness. Designed to protect the wearer's nose, throat and bronchial tubes from large particles of non-toxic dusts, masks weigh less than ⅛ oz and are cool and comfortable. Recommended by manufacturer for foundries, and machine shops except where fine silica dust or toxic dusts are present. *General Scientific Equipment Co.*

Magnifying Glass

11—Sturdily-constructed and at the same time accurate, the 10-power Hastings Triplet Magnifier is designed especially for shop use. Composite lens is dirt-free and lightweight and fully corrects chromatic and spherical aberrations, assuring sharp image to very edge of ¾-in. field of view. Focal length is 1 inch. Magnifier is mounted in simple, anodized aluminum cell with removable handle. Over-all length is 3½ in. *Buhl Optical Co.*

Ferrous Metal Thermocouple

12—Molten metal thermocouple for ferrous metals is designed to withstand melting temperatures up to 3200 F and all casting temperatures normally encountered in the production of precision steel castings. Temperature readings can be made in less than 30 seconds with extreme accuracy, manufacturer claims. Thermocouple is well-balanced sensing unit for use with any pyrometer and has an adjustable extension and uses a 27-gage platinum-platinum 10 per cent rhodium element. Telescoping feature permits feeding of platinum element to proper length within protecting tube, without need for cumbersome reassembling of unit. *Wheelco Instruments Co.*

Crane

13—Handi-Crane, designed for fast, economical handling of materials at plants, railroads, loading stations, etc., is mounted on Minneapolis-Moline Model UTI tractor and has high lift capacity of 5 tons. Boom is raised and lowered by hydraulic cylinder that allows safe and accurate control independent of other operations. An 18 ft or 24 ft boom rotates full 320 degrees and has attached counterweight that permits load to swing at constant radius with absolute safety. Hydraulic stabilizers on front end provide additional stability when handling loads over side. Model UC Handi-Crane has attached pintle hook for towing service. *Clyde Iron Works, Inc.*

Combustion Tubes

14—Offered at new low prices are mullite and zircon combustion tubes. McDaniel combustion tube is a high-temperature mullite tube guaranteed to perform satisfactorily up to 2900 F, is gas-tight, straight and accurately sized and free from devitrification. Zircum high-temperature combustion tube is

(Continued on Page 92)

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FOUNDRY Literature

Readers interested in obtaining additional information on items described in Foundry Literature mail postcard below to Reader Service, American Foundryman, 616 S. Michigan Ave., Chicago 5. Refer to items by circling the convenient code numbers.

Grinding Wheel Bond

15—New vitrified, unbreakable bond for grinding wheels and mounted wheels is described in 4-page folder which outlines advantages and applications of this new abrasive development, claimed to increase grinding and finishing output by from 5 to 10 per cent. *Chicago Wheel & Manufacturing Co.*

Bentonite Data Book

16—Sturdily-bound, vest pocket Foundry Bentonite Data Book contains in index form data regarding foundry practice, mixes, formulas and memoranda. Described in detail are South Dakota-Wyoming Black Hills Bentonites, their uses and advantages. Recommended mixes are given for gray iron, malleable, steel, non-ferrous and heap sands. Several pages of the booklet are blank for jotting down memoranda. *Baroid Sales Division, National Lead Company.*

Electric Furnace Chemistry

17—15-page booklet, *"Theoretical Chemical Reactions in Basic Arc Electric Furnace,"* by H. C. Bigge, Bethlehem Steel Co., provides comprehensive coverage and equations of oxidizing and reducing reactions in basic arc furnace, sulphur elimination during reducing period, desulphurization in basic arc furnace and provides a reduction table for important oxides encountered in the iron and steel industry. Also included is the 1947 report of the International Commission of Atomic Weights. Copies are available without cost. *H. C. Bigge, Bethlehem Steel Co.*

Tramp Metal Magnets

18—Leaflet describes three new ATOMagnet models—Extrapower, Ultrapower and Superpower—each available in a full range of sizes for separation of tramp iron from materials in process. Constructed for use on wood or steel chutes, hoppers, tables, etc., ATOMagnets have five new features: (1) riveted construction, (2) continuous hinge for easy installation, (3) cover that prevents accumulation of iron on backs of castings, (4) insulation that confines magnetic strength to working surface, and (5) flush air gap to prevent shorting-out magnetic field. *Eriez Mfg. Co.*

Chart Recorder-Control

19—Data sheet lists specifications, applications, operating data, etc., for the pneumatic Capacilog, an air-operated control system combined with a strip chart recorder. Featuring the "electronic link," the Capacilog will obtain measurements with any type of primary element producing an electrical impulse, such as thermocouples, radiation detectors, radiation bulbs, etc. *Wheelco Instrument Co.*

Vibrating Machinery

20—Three bulletins describe new vibrating machinery: Bulletin 134—fully-mechanical vibrating feeder that can easily be operated by unskilled labor; Bulletin 135—vibrating conveyor that will handle up to 200 ft of pan length; and Bulletin 136—a combination flask shakeout, sand screener, lump breaker, conveyor feeder and tramp metal trap. Specifications, applications and operating characteristics are given for each of these three units. Robins Conveyor Div., *Hewitt-Robins, Inc.*

Thermocouples

21—Catalog Section 22 lists applications, specifications and similar data for a complete line of industrial thermocouples for all pyrometers. Information is included on selection of thermocouples, wire sizes, immersion lengths, protection tubes, etc. *Thermo Electric Co., Inc.*

(Continued on Page 87)

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CHAPTER ACTIVITIES

(Continued from Page 79)

plate is used. This, the speaker said, would be of value to the customer.

The speaker compared castings with weldments, showing that in the same applications, castings cost less and presented a better appearance. He also stressed need for good foundry housekeeping, which, he said, would attract superior foundry personnel. Constant improvement in the quality and appearance of castings will help to combat competition from plastics and weldments, he concluded.

Washington

Harold R. Wolfer
Puget Sound Naval Shipyard
Chapter Reporter

SPEAKER AT THE November 24 meeting, held in the Gowman Hotel, Seattle, was Thomas E. Barlow, Eastern Clay Products, Inc., Jackson, Ohio.

Speaking on *"Sand and Its Relationship to Casting Defects,"* Mr. Barlow dealt only with casting defects resulting from faulty sand conditions and explained these defects in the light of four basic sand properties—moisture content, strength, toughness and fineness. Sand testing is directly attributable to the molder, Mr. Barlow said, and it is up to the foundry to furnish him with a sand that he likes if good results are to be obtained.

Sand testing is not a completely satisfactory substitute for human skill, Mr. Barlow said, and foundries must by trial and error find the right sand for a job, then make use of laboratory test data to duplicate the mixture, or at least hold its properties within reasonable limits.

One shortcoming of sand testing, the speaker said, is that it only reveals the properties of the laboratory specimen and may not always represent true mold conditions wherein one molder may be ramming too soft and the other too hard. Accurate analysis of casting defects and their relationship to sand conditions aid in correct interpretation of sand test data and insure proper sand mixture for any given job.

Mr. Barlow considered in great detail sand mixtures of varying characteristics and described the defects which might result, the properties causing the defects, and the remedies. He covered sands too wet and too dry, too high and too low in hot strength, too high and too low in permeability, and sands of low and high flowability.

He called attention to the expanding fin defect which looks like veining but is due to expansion rather than contraction. This defect, he said, often occurs in medium to heavy castings

(Continued on Page 86)

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CHAPTER ACTIVITIES

(Continued from Page 84)

having flat cope areas interrupted by a heavy member or section extending vertically into the cope. The sand in the cope is heated by radiation, then by contact, before the mold is filled. The heated part of the mold expands before the upper portion, opening cracks which fill with metal.

The speaker's explanation for pinholing due to high permeability was that gases and steam formed from contact between the molten metal and the facing may find easier exit through the voids of an open facing and into the mold cavity than by a longer route through the less permeable backing sand. Discussion concluded the meeting of the Chapter.

Quad City

Elmer C. Zirzow
Deere & Co.
Chapter Reporter

ANNUAL CHRISTMAS PARTY, held at the Hotel Blackhawk, Davenport, Iowa, December 8, was attended by some 350 members and their guests. Starting off with a fellowship hour, the meeting consisted of an excellently-prepared fried chicken dinner, followed by a three-act vaudeville show "imported" from Chicago.

November 20 meeting had as its speaker Robert P. Schauss, Illinois Clay Products Co., Chicago, who discussed the subject, *"Gating and Feeding of Castings."*

The speaker cited the importance of proper gating and feeding in foundry practice. The necessity for establishing a gating and feeding system based on scientific principals rather than the trial and error method was stressed by Mr. Schauss.

The object of controlling the rate of entry of the metal into the mold and the feeding is to produce sound castings in a practical manner on a commercial basis, Mr. Schauss said.

The speaker referred to flowing of metal into the mold with a minimum amount of turbulence with proper directional solidification. He then explained that in many cases, slight shrinks in castings were not objectionable or did not impair the casting. However, elimination of these slight shrinks would involve an increase in cost. Hence from a cost basis it is not deemed advisable to eliminate these shrinks, Mr. Schauss added.

The speaker explained generally accepted ideas on gating and feeding, comparing old conceptions with newer ideas brought out by recent research work. The flow of the metal into the mold should be controlled since either too fast or too slow a metal entry will produce defects. Various methods of choking for controlling the flow were discussed. The gates should be adequate so that hot metal will be supplied where needed. The use of the atmospheric pressure in the firecracker core and the neck-down riser and Washburn core were discussed.

The speaker concluded by showing slides illustrating various gating systems. In the discussion which followed, it was brought out that increasing numbers of foundries are using ceramic materials for strainer cores and necked-down risers.

Metropolitan

John Bing
Metropolitan Refractories Corp.
Chapter Reporter

OVER 500 FOUNDRYMEN and guests of the Chapter enjoyed an excellent dinner and a fine, professional floor show at Metropolitan Chapter's Annual Christmas Party, held the evening of December 8 at the Essex House, Newark, N. J.

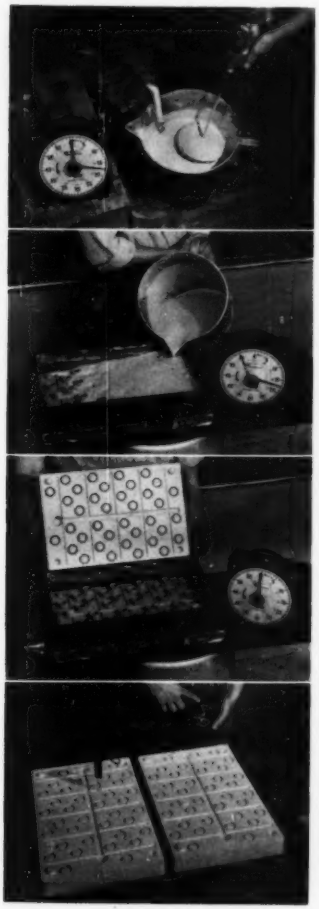
Participating in the November 10 meeting of Northwestern Pennsylvania Chapter, held at Dunkirk, N. Y., were, left to right: Chairman Frank Volgstadt, Griswold Mfg. Co.; Speaker George F. Watson, American Brake Shoe Co., New York; Dr. J. Murdock Dawley, Fredonia State Teachers College, Fredonia, N. Y.; and Director J. M. Morrison, U. S. Radiator Corp.

FOUNDRY LITERATURE

(Continued from Page 82)

Non-Ferrous Casting Plaster

22—Bulletin 1GL-32 describes properties, uses and methods of application of P-M-C, a permeable, completely formulated non-ferrous metal casting plaster, which when combined with recommended proportions of water is claimed by manufacturer to produce an extremely smooth,



permeable molding medium. Recommended uses are for gravity cast cope and drag molds, cores for semi-permanent molds, for insulative riser sleeves and pads and for dry sand mold cores. Shown in the accompanying illustrations are a few of the steps in making plaster molds with P-M-C: (1) Using electric mixer to prepare slurry, (2) Pouring slurry into "cold" rubber core box, (3) Completed mold drawn by hand, and (4) checking plaster mold for "free" water by electrical conductivity method. Bulletin describes needed pattern equipment, mixing, pro-

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R7...Rapid Removable Jolt Squeeze Molding Machine
R9X...Rapid Portable Jolt Squeeze Molding Machine
R10...Rapid Portable Hand Squeeze Molding Machine
R12...Rapid Stationary Hand Squeeze Molding Machine
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Smelting & Refining Division
Continental Copper & Steel Industries, Inc.
BUFFALO 17, NEW YORK

portions, permeability control, mold making, pattern extraction, plaster mold drying and casting the metal. *United States Gypsum Co.*

Abrasive Wheels

23—Complete line of mounted abrasive wheels and points, including vitrified bonded for carbon and alloy steels, resinoid bonded for bronze, brass and aluminum; rubber bonded for tough high-speed operation and smooth finish and flexible rubber and cork resinoid for fine finishing, are described in four-page folder. *Bay State Abrasive Co.*

Centrifugal Pumps

24—16-page handy guide to selection of centrifugal pumps indexes a wide variety of units, including close-coupled, pedestal, double suction single-stage, multi-stage, self-priming, process, solids handling, marine, rubber-lined, paper pulp, sewage, axial and mixed flow pumps. Head capacity charts and tables for various types of pumps are given, together with data on sizes, capacities and construction features. *Allis-Chalmers Mfg. Co.*

Face Shields

25—Face Shields for protection in handling acids and chemicals, pouring hot metal, sanding, grinding and other operations where the face is endangered by flying particles are described in 4-page Bulletin CN-3. Featured are three standard head-gear types of face shield with full-spark guard, semi-spark guard and without spark guard; and deluxe faceshield for large-area protection. *Mine Safety Appliance Co.*

Foundry Cores

26—Effect of sands, moisture and binders on foundry cores is described in a 12-page illustrated booklet. Charts and color graphs illustrate relationships between sand, moisture and binders on green strength, baker strength, hardness, bakability, etc. of foundry cores. *Archer-Daniels-Midland Co. (The Werner G. Smith Co. Division).*

Specimen Mounting Press

27—Illustrated sheet describes the AB Speed Press, a new metallurgist's tool for the preparation of metallurgical specimens in plastic mounts. Advantages, applications, prices are given. *Buehler Ltd.*

Lifting Magnets

28—6-page catalog describes new line of lightweight, all-welded lifting magnets and gives features, size ranges, lifting capacities, dimensions and ratings. Included is a cross-sectional drawing showing detained construction features, materials and design. Installation photographs show types of work on which magnets are now being employed. *Dings Magnetic Separator Co.*

Shakeouts

29—Newly-developed, smaller-sized Foundromatic shakeouts ranging from 2,000 to 5,000 lb capacity are described in new Bulletin 07B7532, which provides design features, sizes and capacities of units,

which are designed to meet needs of smaller foundries and are also available with portable bases. *Allis-Chalmers Mfg. Co.*

Dye Inspection Method

30—Illustrated Bulletin 500 fully describes Dy-Chek, a dye penetrant inspection method for castings and shows how this chemical process simplifies nondestructive testing. Dip, brush and spray methods are explained and applications in factories and in the field are discussed. *Dy-Chek Co., Division of Northrop Aircraft, Inc.*

Copper Alloy Hardeners

31—Vol. 1, No. 6 of Murex, Ltd.'s *Review*, published in England, features an article on "*'Hardeners' for Copper-Base Alloys*," By E. Voce. Other articles in this issue are "*High-Temperature Steels in Steam Plant Practice*," by J. Glen, and "*Method Used in Murex Laboratories for Determination of Titanium and Aluminum in Ferrotitanium*," by E. A. Chidley and A. H. Bowes. Also given are several abstracts of metallurgical articles from leading British, European and American technical publications. Copies of this publication are available to readers on request. *Murex, Ltd.*

Bentonites

32—16-page illustrated booklet describes physical properties of Panther Creek (southern bentonite) and its applications to gray iron, malleable, steel and non-ferrous molding sands. Charts illustrate green compression strengths of No. 50 Silica Sand (96 per cent sand, 4 per cent bentonite), and Michigan City Sand (96 per cent sand, 4 per cent bentonite). *American Colloid Co.*

Super-Refractory Cements

33—8-page illustrated Bulletin No. 314 discusses properties and applications of Taylor Sillimanite Super-Refractory Cements for bonding linings of high-temperature furnaces in the foundry. Described are applications, slag resistance, workability, importance of low shrinkage, types available, and heat-setting vs. air-setting cements. Illustrations show typical applications. *Chas. Taylor & Sons Co.*

Air Hose Bulletin

34—Four-page, envelope size Bulletin No. 129 gives details on design, construction and rubber compounds of Conservo, a general service air hose with rayon cord carcass. *Hewitt-Robins, Inc.*

Mold Drying

35—An 8-page article, reprinted from *Iron Age*, March 2, 1950, "Production Casting 30-Ton Engine Bases," by C. W. Gilchrist, foundry superintendent, Cooper-Bessemer Corp., presents data on handling molds exceeding a foundry's crane capacity and drying oven size. By methods described in this article, time required for making the mold was reduced from two weeks in the experimental model to two days in the final production setup. Illustrations show various steps in the process. *Foundry Equipment Co.*

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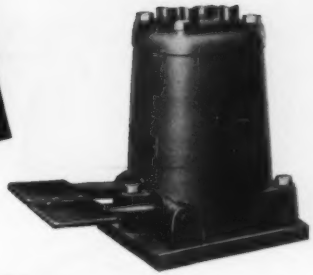

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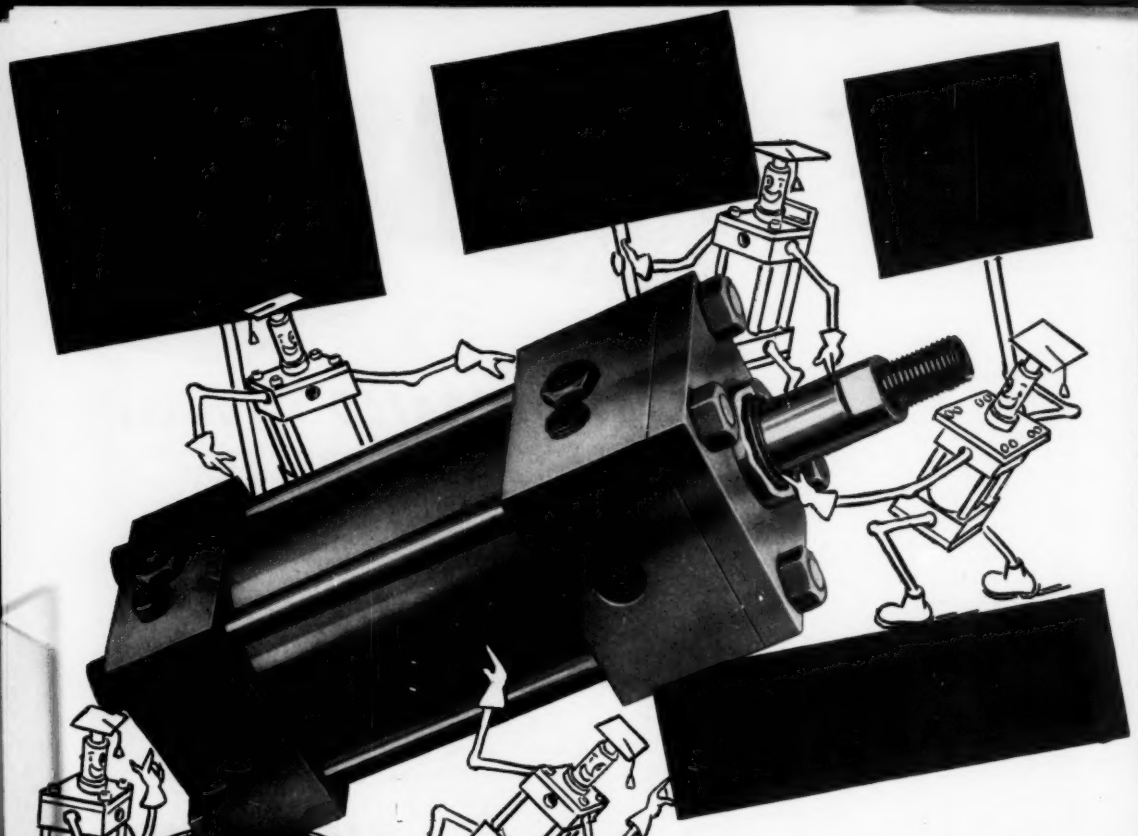

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FOUNDRY FIRM Facts

Whiting Corp., Harvey, Ill., announces the opening of a sub-sales office at 637 Penton Bldg., Cleveland. Acting under the supervision of H. E. Reynolds, Pittsburgh district manager, A. C. Kukral will be resident sales engineer at Cleveland. Mr. Kukral, a civil engineering graduate of Illinois Institute of Technology, served as an ensign in the Navy in World War II, joining Whiting Corp. as a sales engineer upon his discharge from the service. It was simultaneously announced that Whiting has opened a district sales office in Seattle, Wash., at 350 Skinner Bldg., with R. E. Florine as district manager in charge of Whiting equipment sales in Washington, Oregon and Idaho. A chemical engineering graduate of Washington State College, Mr. Florine served in World War II as an engineering officer aboard an escort carrier. He has been sales engineer in the company's New York office for five years.

Syracuse Supply Co., Syracuse, N. Y., has been appointed representative for **Ohio Tramrail** cranes, transfer bridges and tramrail systems in central New York. C. L. McGovern will head Syracuse Supply's sales efforts for Ohio Tramrail.

Cyclotherm Corporation, Oswego, N. Y., was recently purchased by **United States Radiator Corp.,** Detroit. Purchase of the business and assets of Cyclotherm, manufacturers of packaged steam generating units for high-pressure industrial applications, which will be operated as a separate division of United States Radiator, according to U. S. Radiator President Wesley J. Peoples, will materially strengthen the parent company's defense production activity.

Harold J. Roast, bronze foundry consultant, announces the removal of his offices from 15 Church Hill, Westmont, Que., Canada, to 324 Victoria St., London, Ont.

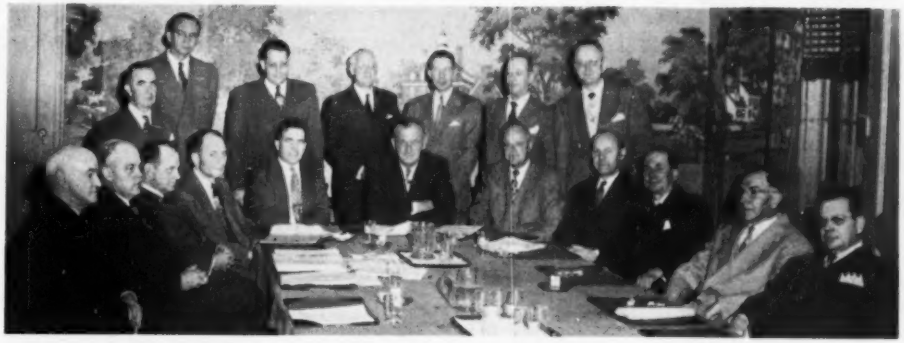
Link-Belt Co. announces the opening of a new factory branch store at 5020 Centre Ave., Pittsburgh 13. This new building provides ample space for stocking power transmission and materials handling products, is conveniently located and easily accessible to all transportation.

Fort Die Casting Corp., Detroit, announces transfer of its complete operations to a new 100,000 sq ft plant at Marysville, Mich. Improved rail and truck facilities will speed flow of materials and increase production of aluminum, zinc and lead die castings for the automotive, construction, appliance and radio industries.

Baldwin Locomotive Works, Philadelphia, on December 4 acquired the assets and business of Lima-Hamilton Corp. and will hereafter be known as the Baldwin-Lima-Hamilton Corporation, carrying on all activities of both companies.

Elected to serve as officers and on the Executive Committee of the **Reading Foundrymen's Association** for 1951 are: *president,* George H. Kissell, Fairmont Foundry Co.; *vice-president,* James S. Hinkley, Dick Brothers, Inc.; *treasurer,* Irwin H. Bossler, American Chain & Cable Co., Inc. Elected to serve on the Association's Executive Committee are: Holton Confer, Confer, Smith & Co.; Paul B. Harner, Union Manufacturing Co.; Morris McKinney, Dick Brothers, Inc.; Paul K. Reiniger, Textile Machine Works; Clair Snell, Keystone Foundry & Machine Co.; and James Woodward, Excelsior Brass Foundry. Elections were held at the Reading Foundrymen's Association's November 21 meeting.

Administrative Council Meets At 52nd Annual NFA Convention



Photographed during the 52nd Annual Meeting of the National Foundry Association, Edgewater Beach Hotel, Chicago, November 9 and 10, were these members of the 1951 Administrative Council of the Association. Seated, left to right: F. R. Hoadley, Farrel-Birmingham Co., Inc.; W. W. C. Ball, Taylor & Fenn Co.; F. J. O'Neill, Western Foundry Co.; H. M. Greenebaum, Acme Foundry Corp.; Franklin Farrel, 3rd, Farrel-Birmingham Co., Inc.; Retiring President Harry E. Ladwig, Allis-Chalmers Mfg. Co.; Incoming President A. V. Martens, Pekin Foundry & Mfg. Co.; Arthur G. Hall, Nordberg Mfg. Co.; J. J. Ewens, Grede Foundries, Inc.; G. A. Kastner, Lincoln Brass Works; and E. N. Reynolds, Detroit Brass & Malleable Works. Standing, left to right: I. R. Wagner, Electric Steel Castings Co.; W. S. Brunk, Headford Bros. & Hitchins Founary Co.; A. L. MacKay, Kaukauna Machine Corp.; L. E. Roark, NFA Executive Vice-President; Incoming Vice-President C. A. Jurgensen, DeLaval Steam Turbine Co.; Treasurer E. B. Sherwin, Chicago Hardware Fdy. Co.; H. Menck, Harnischfeger Corp.

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Green Strength
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Flowability
Moisture
Rammability

2 EASIER CORE MAKING

Green Strength
Blowability
Sagging Resistance
Cracking Resistance
Stickiness
Moisture

3 BETTER MOLD CONDITION

Green Hardness
Air Set Strength
Dry Strength

4 BETTER CORE CONDITION

Dry Hardness
Core Strength
Core Deflection
Moisture Absorption
Gas Pressure

5 CASTING APPEAL

Permeability
Clay Substance
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% Combustible

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Hot Strength
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Write for Free New "Foundry Sand Practise" Book

CONTROL EQUIPMENT

HARRY W. DIETERT COMPANY

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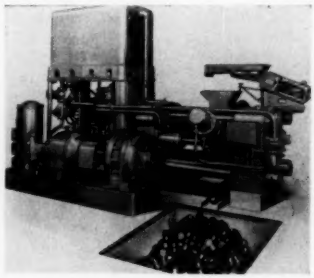
NEW PRODUCTS

(Continued from Page 81)

made from highly purified materials and matures at approximately 3100 F. Both tubes are offered in a variety of lengths and diameters and come with straight, uniform diameters or tapered ends. *Burrell Corp.*

Automatic Briquetting Press

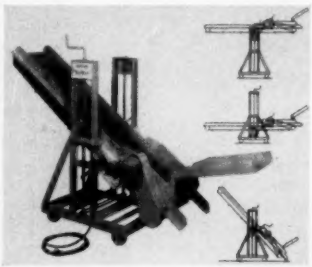
36—Available in five sizes to meet diversified scrap processing needs, Milwaukee Briquetting Presses convert low grade bulk metal turnings, borings, chips and savings into dense cylindrical metal blocks suitable for charging directly into a foundry cupola as high grade scrap. Designed to accommodate steel, cast iron,



brass, magnesium, bronze and aluminum chips, shavings or turnings, these briquetting presses feature compact design, simplified controls, rapid and economical operation and minimum maintenance and require little floor space. All operations are electrically or hydraulically controlled. Pressurized lubrication system serves all moving parts. Individual briquettes range in weight from 3 to 11 lb and are clean, free of oil and other cutting lubricants. Models have gray iron briquette capacities varying from ¾ to 3-½ tons per hour. *Spo, Incorporated.*

Portable Conveyor

37—Designed for wide range of materials handling applications where working heights and areas change frequently and for handling of castings, borings, turn-



ings, chips, granular materials, etc., adjustable and portable conveyors are available in 4, 6, 8, 10 and 12-ft lengths with belts 12, 18 or 24-in. wide. Charging chute has positive trap. Working height is regulated through 30-in. range by

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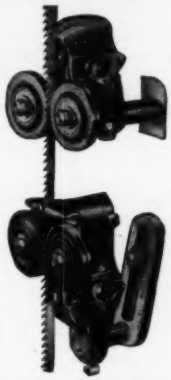
INTER-CHANGEABLE BALL-BEARING WHEELS • TURN WITH THE BLADE • GIVE STRONG FRICTION-FREE SUPPORT



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CONSERVE MAN-POWER

Ball-Bearing wheels are interchangeable for equal wear. Easy to install. In effect they hold working portion of blade in a frame—reduces blade breakage. Immediate delivery.

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SCIENTIFIC Pressure Cast MATCH PLATES

1. The finest quality Matchplates ever produced in our history!
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3. At prices only *slightly* higher than 12 years ago!

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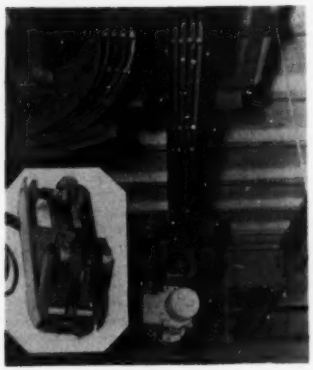
2520 WEST LAKE STREET
CHICAGO 12, ILLINOIS

double-screw center lift and conveyor crank handle facilitates pitch adjustment from horizontal to 45 degree maximum. Portability is provided by two swivel and two stationary casters. *May-Fran Engineering, Inc.*

Shielded Tramrail Electrification

38—Tramrail and crane shielded electrification system for 3-phase operation, with capacities to 600 volts at 75 amp reduces arcing and flashing of conductor bars by using large-area shoe contacts with large



springs in each shoe. Installed directly below tramrail track tread, unit minimizes chance for casual contact by combining under-the-track location with metal housing which shields conductor bars from top and two sides. Feature: copper-bearing mild steel conductor bars; dust-accumulation-proof housing; phenolic resin insulation; and protected trolley current collector. Factory fabricated in 10 ft lengths for on-the-job erection. *Forker Corp.*

Castings Recovery Process

39—Special castings recovery process converts "leakers" to permanent, pressure-tight castings at a low cost. Method is applicable to reclaiming rejects in all types of castings that must withstand liquid or gas pressures. Process is a three-part combination of a seal, equipment and engineering guidance provided by manufacturer. Seal is composed of metal oxides in suspension and is forced through porous areas after metal is heated to expand microscopic holes and cracks and almost immediately effects a tight seal. Details of equipment needed, method of operation and applications are available from *Tincher Products Co.*

Materials Handling Work Glove

40—All-purpose materials handling work glove features wing-type Dura-Thumb that provides additional hand protection. Made of chrome-tanned, side split cowhide with flannel back, glove has water-resistant cuff that can be dry cleaned. Seamless thumb and palm insure flexibility and longer life. Hand stitched throughout, glove is available in two models—Wing King, with 4½-in. gauntlet —and Super B, with 2½-in. safety cuff. *Richmond Glove Corp.*

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ALUMINUM
BRASS
BRONZE
ZINC and
ALL OTHER
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Die coatings . . Pot & ladle coatings . .
Furnace cement . . Welding fluxes . .
Soldering fluxes . . Metal cleaners

IMMUNITAS FLUXES
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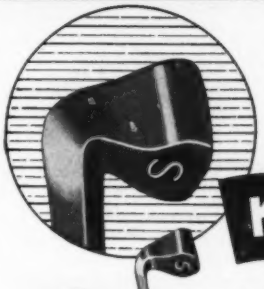

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Coal and Coke

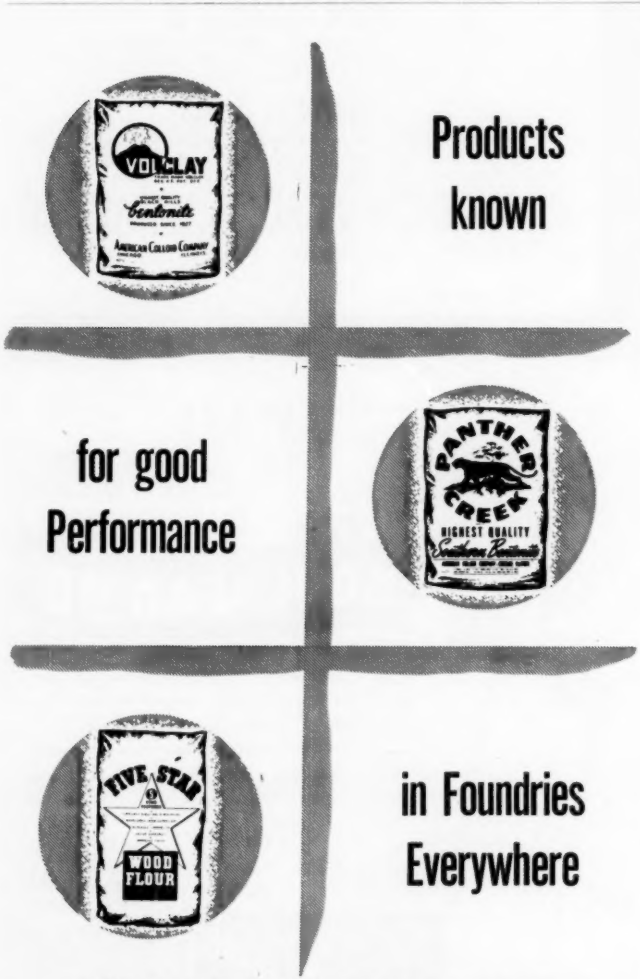
Coal, Coke and Coal Chemicals, by Philip J. Wilson, Jr., and Joseph H. Wells. 509 pp. Illustrated. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. $8.00. (1950).

Each phase of the coal and coke industry—high-temperature coking, coal, recovery of coal chemicals from coke-oven gas and distillation of tar—is dealt with systematically in this volume and other coal-carbonization processes, gas retorts and lower-temperature coking are described briefly. Photographs and diagrams are used liberally and a bibliography and list of visual aids pertinent to the subject are provided.

Steel Casting Industry

A History of Steel Casting, prepared under direction of William H. Worrilow. 168 pp. Published under auspices of Steel Founders' Society of America. 920 Midland Bldg., Cleveland. $2.50. (1950).

Stressing the role of the steel casting industry in the nation's economy, this volume includes a general history of the ferrous foundry industry and reports on the origin of steel castings in Europe and the United States. A detailed primer of steel casting production covers original methods and subsequent advances in furnace practice, process, molding, pouring, patternmaking, cleaning and finishing, testing and inspection. Illustrated throughout, this volume contains some 50 photographs of individual plants, personalities and processes, and scratchboard sketches. Concluding the book is a description of the history, personnel and functions of the Steel Founders' Society of America.



Plastics

Modern Plastics Encyclopedia. 1371 pp. Illustrated. Published by Plastics Catalogue Corp., 122 East 42nd St., New York 17, N. Y. $5.00. (1949).

Designed as a practical working guide to where to use plastics, which plastics to use, which production methods to use and how to design for plastics, this newest edition of *Modern Plastics Encyclopedia* contains up-to-the-minute information on every phase of plastics. Most comprehensive treatise on plastics available, this volume contains a special 200-page feature section showing more than 1000 successful plastics applications in 27 basic products classifications. Thoroughly revised buyers' guide is designed to meet the needs of those engaged in the procurement of plastics materials, equipment, machinery, supplies and services.

Wartime German Non-Ferrous Industry

The Non-Ferrous Metal Industry in Germany During the Period 1939-1945, British Intelligence Objectives Sub-Committee Surveys Report No. 23. 198 pp. Published by His Majesty's Stationery Office, London. Copies may be purchased from British Information Services, 30 Rockefeller Plaza, New York 20, N. Y. $.90 postpaid. (1950).

Published in this volume are the reports of some 800 British investigators who made more than 300 trips through German non-ferrous smelting, refining, casting and fabricating plants. Reported are smelting and refining, casting and wrought fabrication and finishing processes, alloys and uses and applications for light metals, base metals, rare and precious metals.

Wartime German Ferrous Industry

The Ferrous Metal Industry in Germany During the Period 1939-1945. British Intelligence Objectives Sub-Committee Over-All Report No. 15. Published by His Majesty's Stationery Office, London. Copies available from British Information Services, 30 Rockefeller Plaza, New York 20, N. Y. $1.15. (1949).

Combined reports of British investigations into all phases of the German wartime ferrous industry are divided into nine sections: (1) Blast Furnace Plant and Practice, (2) Production of Steel, (3) Me-

chanical Treatment, (4) Foundry Practice, (5) Steels, Ferro-Alloys and Hard Metals, (6) Heat Treatment, (7) Cutting, Joining, Repairing and Fastening, (8) Coatings, and (9) Research and Testing. Each section of the report consists of a general survey, a list of references and a list of all relevant official reports.

Refractories

Refractories—Third Edition, by F. H. Norton. 782 pp. Illustrated with charts, drawings and photographs. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. $8.50. (1949).

Third edition of this well-known text is a complete revision and contains new material representing wartime advances, such as: nonplastic casting, hydrostatic molding, hot pressing, laboratory furnaces, properties of pure refractory materials, refractories for nuclear power generation and for jet propulsion. Rewritten extensively are sections on molding, plasticity, raw materials, firing, refractories for steel manufacture and for steam power generation. Many illustrations have been added or redrawn for greater clarity.

Casting Design

Fundamentals of Casting Design as Influenced by Foundry Practice, by Oliver Smalley. 62 pp. illustrated with charts and diagrams. Published by Herington Advertising, Inc., 271 North Ave., New Rochelle, N. Y. $1.65. (1950).

Written by Oliver Smalley, president, Mechanite Metals Corp., New Rochelle, N. Y., this 62-page book represents several years' cumulative experience in the basic principles of engineering design as a means of obtaining sound, uniform, quality castings. This volume provides specific, well-illustrated examples of correct and incorrect design practice and offers a series of definite rules to be followed.

Chemical Engineering

Chemical Engineering Handbook, Third Edition, edited by John H. Perry. 1884 pp. Illustrated with charts, diagrams and tables. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. $15.00. (1950).

The third edition is a virtually complete revision of this standard chemical engineering reference work. Included is a fresh and comprehensive coverage of both standard and recently compiled facts, figures and methods applicable to chemical engineering and its related fields. Several entirely new sections are provided in addition to expanded and wholly revised chapters and completely rewritten major sections. Among improvements in the new edition are increased coverage and new treatment of material on flow of fluids, heat transmission, solvent extraction, mixing and adsorption; a thorough revision of material on fuels, mechanical separation, safety and fire protection, accounting and cost finding; and greatly expanded material on process control, gas absorption, plant location and movement and storage of materials. More than 2000 charts, diagrams, flow sheets and cross-sections are included and an extensive index makes use of common words and their synonyms.

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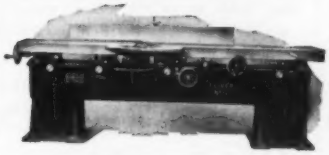

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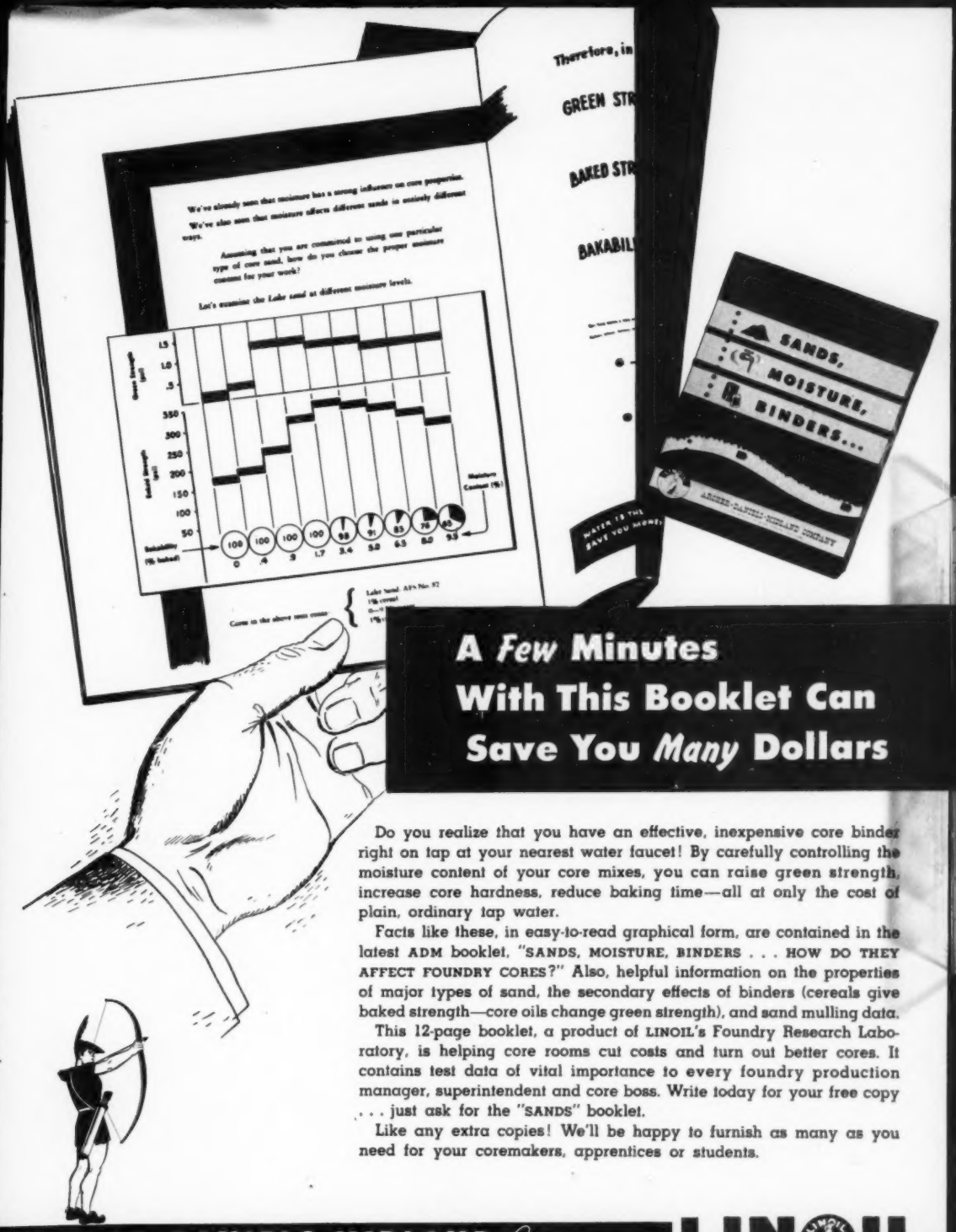
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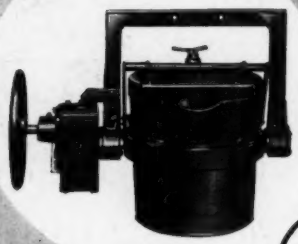

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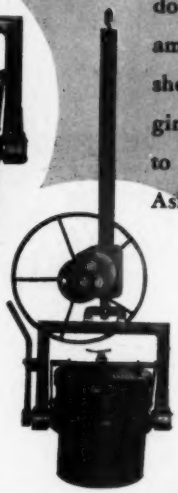

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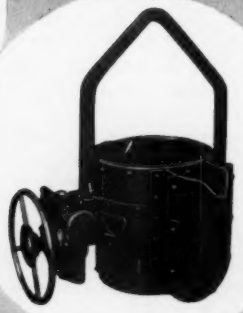

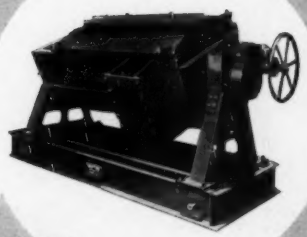

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